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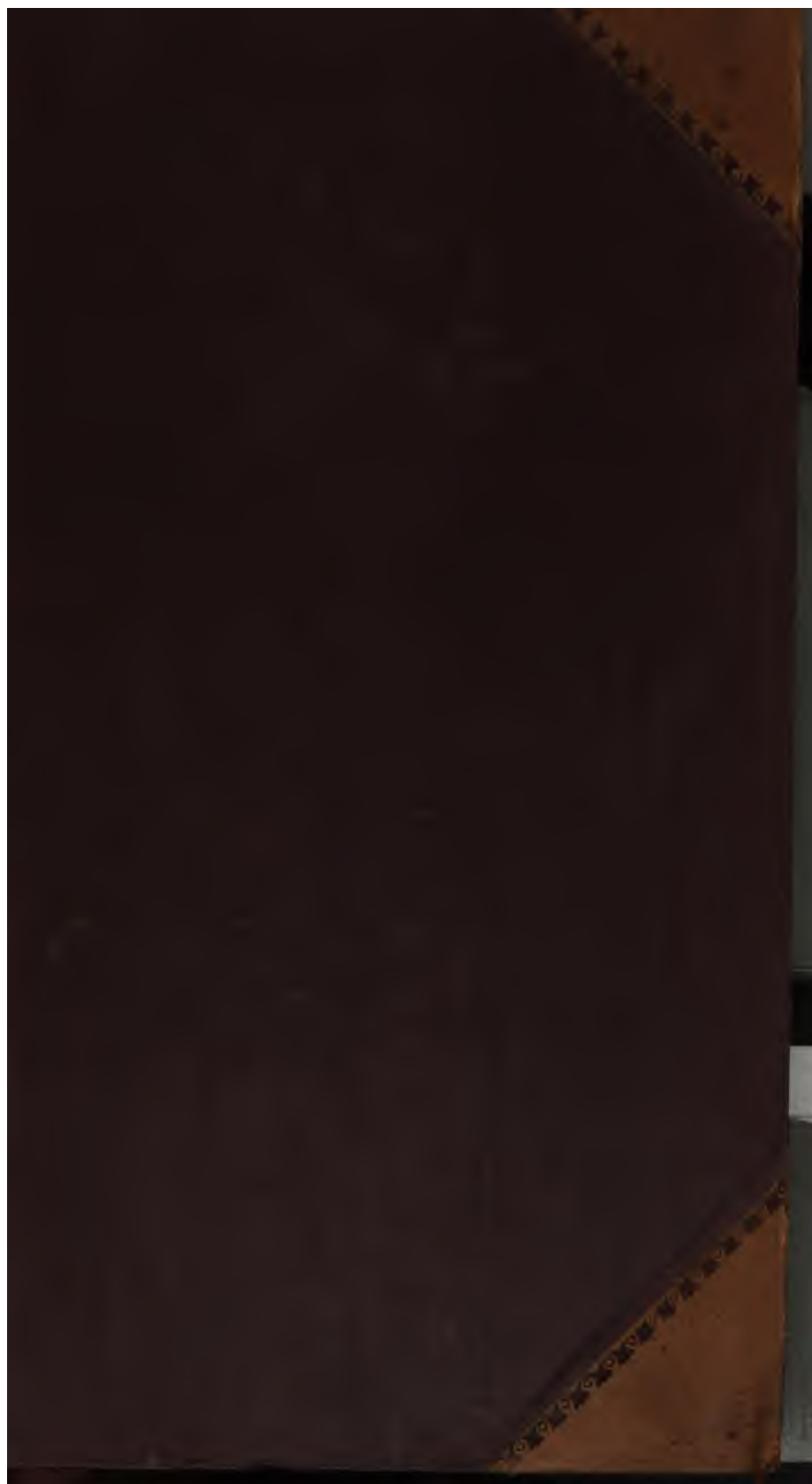
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**NEWTON'S**  
**L O N D O N J O U R N A L**

OF

**Arts and Sciences;**

**BEING A RECORD OF THE PROGRESS OF INVENTION  
AS APPLIED TO THE ARTS.**

[ESTABLISHED IN THE YEAR 1820.]

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**VOL. XVIII.**

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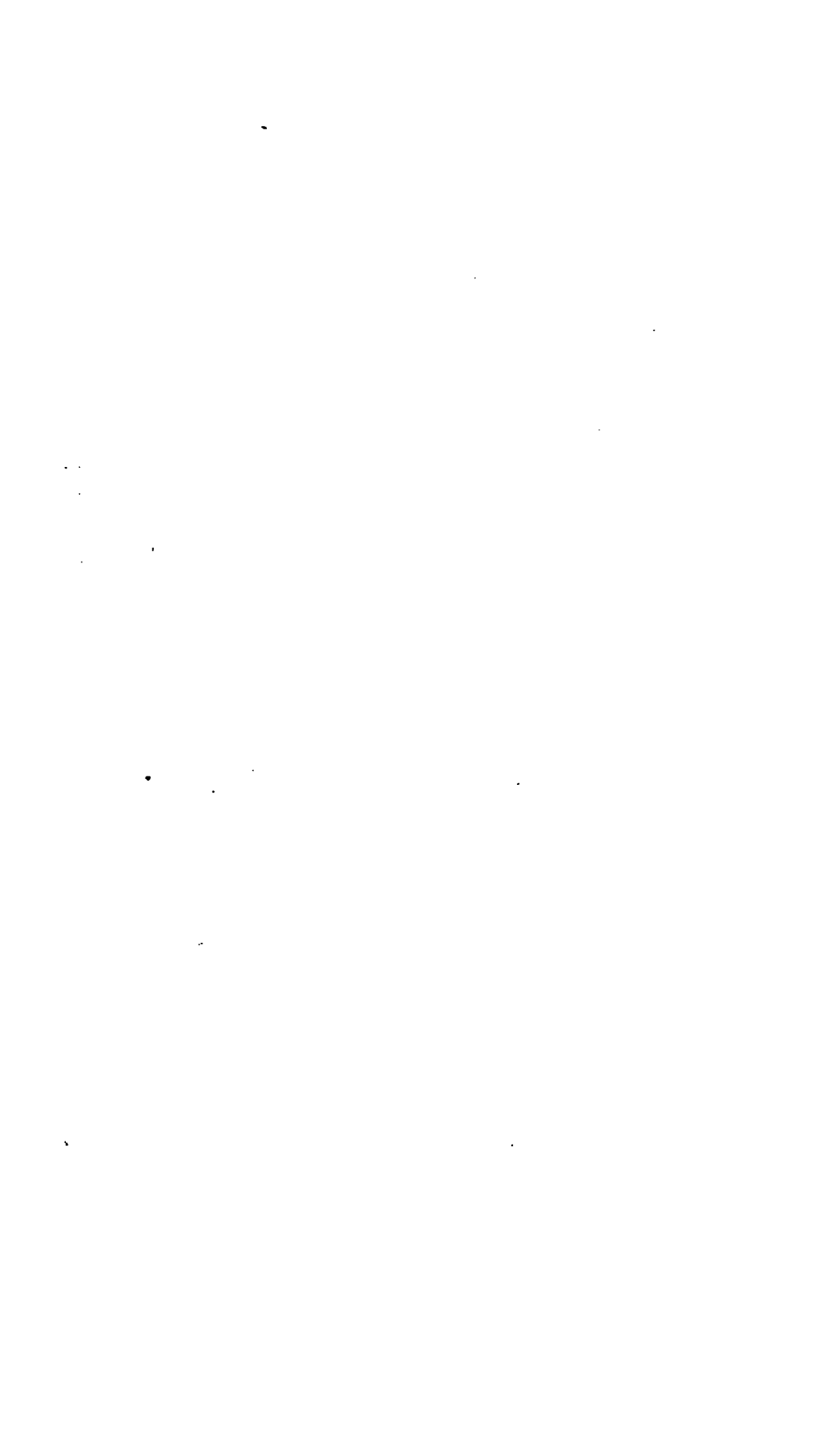
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- III. Longley's Brick Making Machinery; Newton's Brewing; Newton's Discharging Cannon; Tatham's Warp Lace; and Laveissière's Tube Making Machinery.
- IV. Tristram and Brereton's Sizing; Henry's Propelling; Auld's Boiler Feeding Apparatus; Robertson and White's Cocks; Cambridge's Washing; Sanderson's Driving Bands; and Newton's Cork Cutting.
- V. Van der Byl's Brakes; Blakely's Ordnance; Johnson's Moulding; Simpson's Letter Boxes; Vickers's Ordnance; Carter's Chimney Tops; Wilson's Railway Wheels; Newton's Railway Couplings; and Bakewell's Electric Telegraphs.
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# NEWTON'S

## London Journal of Arts and Sciences.

No. CIII. (NEW SERIES), JULY 1st, 1863.

### THE PATENT OFFICE MUSEUM.

THE recent discussion in the House of Commons that preceded the vote for the purchase, by the Government, of the land at South Kensington, now vested in the Commissioners of the 1851 Exhibition, as representatives, as is generally believed, of the public, opens up a subject of serious moment to patentees and manufacturers generally. The first and most obvious thought suggested by the discussion is, that the star of the votaries of practical science must surely be in the ascendant; for it is not often that such words escape the lips of a Prime Minister of Great Britain as these:—"Any one who considers the value of a great collection of models and inventions to those employed in the mechanical and productive arts of the country must know that it is of great importance that they should have access to a repository in which they can find every thing connected with each particular department of industry." So generous, though somewhat tardy, a recognition of the patient, earnest labours of inventors and those who live by the development of new and improved industries, implied in these words, might well arouse the hopes of the sanguine, and reassure those who have anticipated, as a possible consequence of the recent anti-brain-work agitation, the abolition of the patent laws. We must not, however, draw our inferences too hastily from this complimentary passage in the Premier's speech, neither are we driven to the inevitable conclusion that the Chancellor of the Exchequer was burning with zeal for the good of inventors, when, in reference to the present state of the Patent Museum at South Kensington, he said, "Instead of its being an exhibition of patents, things are heaped together in a way which prevents their being seen, and continues a scandal to the country." We never heard it said in Parliament, and much less by a cabinet minister, that it was a scandal to the country when we possessed no patent museum; nor was it considered a scandal when our "Patent Office" consisted of a small back room in Quality-court, without either indexes or specifications of patents; but now that we possess a Patent Office, with a public library, containing, amongst other useful works of reference, all the specifications enrolled from the earliest period, and moreover a museum of inventions, crowded though it be, we hear for the first time of the scandalous neglect of the special interests of the manufacturing community. What, then, has brought about this solicitude of the Government for a

hitherto little regarded interest? The cause is by no means an obvious one, and yet we think it is not very deeply hidden.

It will be remembered that out of the Exhibition of 1851 sprang the Museum of Ornamental Art, as it was termed, which was designed to meet a real, though not perhaps a generally-recognised, want, viz., a means of instructing the public in the true principles of decorative art. By the aid of a small Government grant judiciously applied, and by the loan of private collections of works of decorative art, the contents of the Museum soon assumed formidable proportions; thereby outgrowing the capacity of Marlborough House (the first domicile of the collection) adequately to exhibit them. In the meanwhile the Commissioners of the 1851 Exhibition, having been burdened with a troublesome surplus, determined to devote it to the encouragement of science and art, and to that end secured the Kensington property, known as the Gore House estate. Whether or not the Commissioners, at the time of this purchase, had formed any definite plans for the application of the land, is a matter of doubt, but certain it is, that from the first, the purchase was looked upon very suspiciously in the House of Commons; and the undefined connection of the Society of Arts with the scheme, whatever it might be, and the honours, and something more, in the shape of appointments, in a new public department, which some of its leading members had secured, added great weight to sinister surmises that were at the time very prevalent. Visions of an enormous job looming in the distance perplexed the public mind, until it was assuaged by a Government assurance that a small grant for the temporary housing of certain articles of vertu, and other objects of interest belonging, or generously loaned, to the nation, was all that was intended to be asked for. Thus commenced that novel architectural group irreverently termed the "Brompton boilers"—from its strong resemblance in material and structure to waggon-shaped steam-boilers—in which is now installed, as a permanent institution of the country, the Department of Science and Art.

When the exhibition sheds, now known as the South Kensington Museum, were erected, the difficulty was to know how to fill them, and a happy thought—by whom originated we know not—was to secure some models of machinery, which would give to the institution a colourable right to its title. Fortunately, at this epoch, Mr. Woodcroft, the superintendent of specifications at the Patent Office, had been collecting, for his own pleasure, models, curious from their historical relations to the progress of practical science; and having received encouragement and some aid from the Patent Commissioners, he was in a fair way to accumulate a large number of illustrations of our manufactures. A request to fill one of the Brompton sheds came, *therefore, most opportunely*; for few men, when riding a hobby, stop

to consider where it will land them; and certainly Mr. Woodcroft, who has been nonplussed by the natural growth of his printed specifications and public library, would long since have been puzzled about the stowage of his models, if a Brompton boiler had not yawned for their reception. Thus, then, commenced the Patent Museum, under the auspices of the Patent Commissioners; and from the active looking-up of patentees, and the friendly co-operation of engineers, it was speedily supplied with illustrations of patented and other machinery, on loan, and by gift, and purchase. A keeper and other officers were appointed by the Commissioners, and funds allowed by the Treasury to cover the necessary expenses of this division of the South Kensington Museum. Science and Art were now enthroned; but as Art was of the scantiest, many attempts were made to entice paintings westward, and here again fortune attended the indefatigable coterie who have nursed this offspring of the '51 Exhibition from its birth. The inadequate accommodation in the National Gallery for the Vernon pictures afforded an opportunity of giving them an airing at Brompton; and the noble gift of Mr. Sheepshanks required also a gallery for itself. A collection of educational appliances and of building materials might well be combined in a science and art museum; these were therefore added; and from time to time additions were made to the building by public grants, until an extensive area was covered.

As the experiment proceeded, the experimenters worked with more boldness; for, having secured the co-operation of the Government—in what manner can only be surmised—they were no longer content with an iron shed, but planned exhibition rooms, on a more extended scale and sumptuous style; drawing all the while from an unwilling House of Commons more ample funds for the accomplishment of new schemes. How many additions the Museum has had, and at what outlay, we know not; but certain it is, that at South Kensington there is now a most palpable proof of a science and art department. It is, however, evident that we have at present reached but the threshold of the scheme which the future is to reveal. Last year's international exhibition was evidently designed as another step in advance. The building, according to the charter of incorporation of the Exhibition Commissioners, was to be erected on, and was to cover, the unappropriated portion of the Gore House estate, one part of which had been devoted to the Museum, and another more recently to a botanical garden. A portion of the building, moreover, was to have the characteristics of a permanent structure; and in order that the Society of Arts might have a hold on the property, a clause in the charter secured to that Society the right to lease the permanent structure, though under what pretext, or for what possible purpose, has never transpired. The pecuniary failure of the Exhibition of 1862 has somewhat disarranged this beautiful and

complex scheme, whereby the genius of certain active members of the Society of Arts was to be allowed to disport "in fancy free;" but as our political leaders are all alike committed to the scheme for colonizing this favoured locality, the Government must needs ask for a vote to purchase the land and buildings. Strong indications of a determined opposition to the proposition induced Lord Palmerston to secure the land at once, and postpone the consideration of the purchase of the buildings; but how to make the scheme palatable, even in this modified shape—that was the question. Some new national requirement must be found, in place of those which had already been ventilated and condemned by the House of Commons. Happily for the Government, this was not far to seek; for, in their last year's report, the Patent Commissioners, as our readers will remember,\* had memorialised the Treasury on behalf of a magnificent scheme for a Palace of Industry of their own, including a patent office, a public library and reading-rooms, and a museum of patented inventions, which was to form "an historical and educational institute for the benefit and instruction of the skilled workmen employed in the various factories in the kingdom." Their ideas were, however, modest, compared with those which we are now considering, for their utmost desire was to appropriate the accruing surplus income of the Patent Office, amounting to some £50,000 per annum, to the development of the plan shadowed forth in their memorial to the Treasury. Here, then, was found a national want which pressed for instant attention, and one, moreover, that possessed the desired element of novelty. The Prime Minister therefore seized the chance thus presented to him, and, in introducing his case for the purchase of the seventeen acres of land covered by the Exhibition building, boldly asked for three acres of space on this account, remarking—to give point to his modest estimate of the requirements of patentees—that "in America, a country not supposed to be addicted to unnecessary ornament, but where a great disposition is shown to practical improvement, there is a Patent Museum which covers seventeen acres." The cost of this tribute to inventive genius is estimated at £200,000.

Now it should be remembered, that the admitted available surplus fund of the Patent Office stands, in the last Commissioners' report, at £129,000, although our estimate, which is the correct one, puts it at a trifle below £270,000; for this single object, therefore, far more than the admitted surplus, which is required for very urgent and important uses, will be absorbed. With respect to the appropriation of public money for other interests, we do not, for the moment, care to take account. It may be very well, as is proposed, to adapt five acres of the Exhibition building to receive a portion of the overflowing treasures of the

\* *Report of the Commissioners of Patents for Inventions for 1861, Vol. XVI., page 193, Lon. Jour. N.S.*

British Museum, and to apply another half-acre to the purpose of a National Gallery of Portraits; but what we protest against is, the absorption of the surplus funds of the Patent Office in any such project as that which the Government has just taken in hand. No one can be more anxious than ourselves to secure a suitable building, wherein to transact the business of the patent department; but a Patent Museum is, as we have before shown, an expensive folly. If it existed at all, it should, as Mr. Gregory very properly remarked (in the able speech in which he condemned the whole Government plan), "be along with the specifications in which the patents were described;" and it was not contemplated, as the Chancellor of the Exchequer subsequently stated, to place the Patent Office at South Kensington. A Patent Museum there may be, for aught we care, and we should not even object to inventors being used for the nonce as a stalking horse to help the Government out of a fix; but we do protest against the appropriation of funds, wrung from the pockets of inventors, solely for the purpose of furthering the views, to use Mr. Gregory's own words, "of that craving, meddling, flattering, toadying, self-seeking clique, that had established itself at Kensington; that had been doing a good business there; and now wanted to extend its operations."

The Patent Office fund, on which inventors have a claim, ought not, we think, to be thus recklessly appropriated; unless Government is willing to provide, independently of that fund, the pecuniary means for establishing, what appears to be the unanimous wish of the several interests concerned, viz., a special tribunal for the settlement of all questions arising out of the administration of the patent laws. Perhaps this willingness exists, and the Patent Museum is but a superadded boon, in recognition of the national services of inventors. If it be so, let us acknowledge the honour when it comes, and, barren though it may be, with thankfulness. In the meanwhile, in anticipation of the scheme, we would offer to certain of our manufacturers, who, notwithstanding the march of improvement, have shown a strong "conservative" tendency in the conduct of their business, a hint that may conduce to their profit. In the Patent Commissioners' report to the Treasury (dated August 7th, 1862), urging the desirableness of constituting a Patent Museum, occurs the following passage:—"Amongst the various things necessary to be done, in order to accomplish this object, it is considered to be of great importance, that machines, and exact models of machines, in subjects and series of subjects, showing the progressive steps of improvement in each branch of manufacture, should be exhibited." Our advice upon this proposal is, that those who, with antiquated machines, have been hopelessly struggling against the superior advantages of their competitors, obtained by the introduction of new machinery, shall yet awhile preserve



these heirlooms of their families from the melting pot—as compensation for the losses they have occasioned may perhaps be found in the purchase, for the Patent Museum, of what will undoubtedly help to illustrate “the progressive steps of improvement.” There are still to be found at Nottingham some rare specimens of lace machinery and knitting frames, which, whatever may be their intrinsic worth, will be invaluable, as showing the progress of improvement. The West of England could also afford some favourable specimens of “old fossils,” relating to the woollen manufacture; and, indeed, wherever, in our manufacturing districts, poverty and indolence are combined, there rare examples, suitable for an historical museum, are sure to be found.

### Recent Patents.

To THOMAS SUTTON, of *Saint Brelade's Bay, Jersey*, for improvements in preparing albumenized paper for photographic purposes.—[Dated 28th October, 1862.]

In the ordinary method of preparing albumenized paper, for photographic printing purposes, the sheet of paper is floated upon the surface of liquid albumen, but without having undergone any previous preparation, in order to render it impervious to liquids; the albumen, therefore, soaks into it, more or less, according to the nature of the common sizing which it contains. Moreover, in the subsequent operations of printing, the various solutions employed penetrate the paper in the same way. The prints are, therefore, less vigorous and brilliant, and also less permanent, than if the albumen had been applied to the surface only, or to a sheet of paper which had been previously rendered impervious to liquids by the application of some waterproof sizing. In order to remedy this defect, it is proposed, according to this invention, to prepare the paper, before albumenizing it, by soaking it in a solution of india-rubber or gutta-percha, in benzole, or any of the other suitable solvents of these substances; for example, chloroform, kerosolene, or bisulphide of carbon. A very good solution for the purpose consists of five grains of india-rubber dissolved in one ounce of benzole. After the paper has been immersed in this solution, and dried, it is to be albumenized in the usual manner.

The patentee claims, “preparing albumenized paper, for photographic purposes, as described.”

To CHARLES STEWART DUNCAN, of *Inverness-road, Bayswater*, for an improved compound or material for coating or covering metallic and vegetable substances, to preserve them from corrosion or decay.—[Dated 28th October, 1862.]

THE compound forming the subject of this invention is prepared as follows:—Marine glue, gutta-percha, india-rubber, shellac, copal, mastic, vegetable or mineral pitch or tar, or resin, or iodine, sulphur, creosote, asphaltic bitumen, or coal tar, is combined with one or more of the follow-

ing substances, viz. :—Alumina, schist, quartz, slate, silix or flint, marble or pozzolano, sand, sandstone, cement (natural or artificial), chalk, glass, emery, tripoli, white oxide of zinc or of lead, or the litharge or red oxide of lead, in every case reduced to a fine and nearly impalpable powder, in proportions varying from one-fourth part to five parts of these powdered materials to one part or more of the before-mentioned plastic substances. The materials are then to be heated, so as to reduce them to a plastic or semi-liquid state. The metal to be coated with the compound is also heated to a moderate temperature, and while heated, the compound is to be applied with brushes, or by any convenient method. Immediately after the coating has been laid on the metal, wood, or other body to be preserved, and before it is allowed to cool, the compound is to be covered with a layer of one or more of the mineral powders before mentioned, in a warm state, in order entirely to remove all stickiness or tack. When the compound has become cool, the surface may be brought to a smooth or polished exterior by rubbing it with any substance ordinarily used for polishing metallic surfaces. In cases where necessary, the metals or woods may receive a further protective coating or varnish, composed of copal, cupreous or other varnish, or naphtha, paraffine, camphine, petroleum, or other mineral or vegetable oils, or silicate of potash or of soda and sulphuric acid, mixed with one or more of the above-named pulverized substances. The coatings may be repeated, if it is desired to obtain extra thickness and protection.

The mineral earthy substances must in all cases be thoroughly washed and freed from impurities, and then be kiln-dried, to desiccate and destroy vegetation. For a very hard coating, the substance should be composed of seven or eight parts of silica, or pozzalano, or chalk instead of silica, to four parts of mineral pitch or tar, and two parts of vegetable or Stockholm tar. The protective compound may be applied to the preservation of ropes or strands of hemp, or to any fibrous or textile materials or fabrics.

The patentee claims, "the manufacture of the improved compound or material, substantially in the manner described."

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*To JAMES GARTH MARSHALL, of Leeds, for improvements in the treatment of the straw of flax, hemp, and other similar vegetable substances preparatory to spinning the fibre thereof.*—[Dated 31st October, 1862.]

THIS invention relates to a new combination of processes whereby fibre may be obtained from the straw of flax, hemp, or other analogous fibrous plants,—the object being, to obtain the useful fibres from the plant without using the scutching and heckling processes; and, generally, without resorting to the process of retting. This latter process may sometimes, however, be carried on to a certain extent. In place of retting, a chemical process is used to effect the softening of the binding matter contained in the straw.

The flax straw is steeped in a hot or cold alkaline solution for an hour or two, and afterwards boiled in a solution of soap with an excess of alkali. The fibres are then washed in a weak acid solution, in order to neutralize the alkali in the soap; after which the fibres may be washed in clean water, and dried. These operations may be repeated when a very fine fibre is required. After the gummy matters have been sufficiently softened, and the fibres have been washed and dried, they are to be passed

through a breaking machine, consisting of two or more pairs of fluted rollers, between which the plant passes; and the boon or woody matter will thereby be broken, so that it may be easily detached from the fine fibres in the subsequent operation of carding. This operation may be carried on in a separate machine, such as is in ordinary use for this purpose; or, if preferred, the fluted breaking rollers may be adapted to the feeding end of the flax carding engine, so as to combine the two operations of breaking and carding in one machine.

As the ordinary processes of scutching and swingling are dispensed with, and the fibres are only carded after passing through the breaking machine, the preparatory chemical process above mentioned may be carried much further than when the fibres is submitted to the operation of scutching. By thus allowing the chemical agents to act on the straw for a longer time, or by subjecting the straw to a greater number of operations than can be done if the straw is intended to be scutched and heckled, very fine fibres may be produced. The carding operation will have the effect of clearing the fibres from all extraneous and woody matter; and the cleansed fibres, thus obtained without knots or noils, may be prepared and spun without heckling, and used, either for fabrics made entirely of flax, hemp, or other analogous fibres, or for fabrics made of an admixture of such fibres with other fibres; or the fibres thus produced may be used as a substitute for cotton.

The patentee claims, "treating the straw of flax, hemp, and other analogous vegetable substances, by the combination of processes herein set forth, whereby the ordinary processes of retting, scutching, swingling, and heckling may be dispensed with."

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*To PETER WILLIAM REUTER, of St. John's Wood, for improvements in dyeing,—being a communication.*—[Dated 4th November, 1862.]

THIS invention relates to a new process for dyeing or coloring wool or woven fabrics thereof. To this end the inventor mixes slacked lime, in the proportion of one pound to every 100 gallons of water, or thereabouts, and adds to the clear solution powdered oxide of lead, litharge, minium, or massicote, or other salt or compound of lead, in the proportion of about two ounces to every pound of wool or woollen fabric to be dyed. He then adds carbonate of soda, in the proportion of about one ounce to every pound of wool or fabric to be operated upon. Having thus formed the bath or mixture intended for the dyeing or coloring of wool or woven fabrics thereof, he proceeds as follows:—The wool or fabric to be dyed is placed in the mixture or bath, which is gradually raised in temperature to 180° Fahr. After the wool or fabric to be dyed has attained the desired intensity of color or tint, it is removed from the bath and dried; or it may be subjected to what is known as a soap bath, and afterwards to a bath containing water acidulated with hydrochloric or other suitable acid, and, finally, to several washings in cold water, as is well understood. By this means, any lime or other substances which may have attached themselves to the wool in the process of dyeing are removed.

The patentee claims, "the peculiar process of dyeing wool or woven fabrics thereof, by the use of salts or compounds of lead and alkaline solutions."

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*To RICHARD ARCHIBALD BROOMAN, of Fleet-street, for improvements in apparatus for carburetting and burning gas,—being a communication.*  
—[Dated 9th January, 1862.]

THIS invention consists in enriching lighting gas with carbon, in manner hereafter described, whereby the brilliancy of the light is increased.

According to one arrangement, which is shown in Plate I., at fig. 1, a vessel *a*, containing naphtha, is placed inside a lamp *b*. The spindle *c*, of a gas burner passes through the carburetting vessel, the upper part of which is tubular, and space is left all round between the spindle and the tube. Surrounding the spindle, in the vessel, is a cotton or other wick *d*, the lower portion of which enters the naphtha. A tube *e*, united by a joint *g*, to another tube *f*, leads from the gas pipe or spindle outside of and below the vessel, to the upper part thereof, whereby gas is led into the vessel, which, pressing on the liquid contained therein, drives the liquid up the wick; and the gas following, they become mixed, and are consumed together at the burner. The wick is protected from contact with the flame by an oval or circular plug *h*, pierced with holes or with a saw-cut. A portion of the gas to be consumed flows up the spindle to the burner in the ordinary manner. During the passage of that portion of the gas which is led into the carburetting vessel along the wick, it becomes charged with liquid, and is consumed, when it reaches the burner, together with the gas which has not passed through the naphtha. A current of air, flowing between the gas supply-tube and the carburator, assists combustion. The current may be made double, as in ordinary lamps, or it may be a simple current, according to the carburetting liquid. By the mingling of the two flames—one of ordinary coal gas, and the other of the carburetted gas—the middle of the gas flame, which is usually black (owing to the quantity of carbon deprived of contact with the air), becomes brilliant, and the intensity of the flame is thereby materially increased.

Fig. 2 is a vertical section of a lamp fitted with a carburetting apparatus, the arrangement of which is somewhat modified from that previously described. The lamp *A*, has an ornamental top *b*, fitted to it, for containing the carburetting liquid; *c*, is a tube leading from the top *b*, to the tube *d*; in its course it is guided round the interior of the lamp for leading the liquid from the top or reservoir *b*, to the wick, whereby the latter is kept moist and prevented from getting overheated. In certain cases, the whole current of gas passes into the interior of the carburator. Below the lamp *A*, there is also a vessel *e*, provided with a cleaning-out tap *f*; the excess of liquid falls into this vessel *e*. There are two apertures in the pipe *d*, below the vessel *e*, one (*g*), of which is continued the whole height of the tube, to allow the excess of liquid which the wick imbibes to overflow; the other (*i*), for leading the gas to the lateral tube *j*, which latter enters the lower reservoir *e*, by the orifice *l*. *m*, is a two-way tap, common to the two apertures, worked by the rod *r*, for allowing the liquid and gas to pass at the same time, and for shutting both off from the burner. The wick *h*, surrounds the tube *d*, and dips into the liquid contained in the reservoir *e*. *n*, is a jacket surrounding the wick, at the top of which a burner *o*, is screwed, which may be of the shape shown, or conical, or it may be a burner of the ordinary construction: it is made of metal or of enamelled or glazed metal; porcelain or glass may be used, or

other analogous compositions. The wick *h*, as well as the inside of the burner *o*, may be covered with metallic cloth.

Fig. 3 is a view, partly in section, of a lamp fitted with a carburetting apparatus, being still another modification of the foregoing arrangements. *a*, is a reservoir, which may be spherical or of any other convenient shape, placed inside the lamp *b*. The reservoir is screwed on to a pipe *c*, by which the gas passes, and is fitted with a tap *d*. At the junction of the pipe *c*, and reservoir *a*, there is a tube *f*, which is led round the inside of the reservoir to the upper part thereof, to give a free passage to the gas. A guard *h*, surrounds the wick *i*, which is placed on a tube *j*, screwed to the inner part of the burner *k*. This tube *j*, dips almost to the bottom of the reservoir, and the cap terminates in a butterfly or other burner, according to the description of light required.

The patentee claims, "First,—the employment, in apparatus for carburetting and burning gas, of a wick and burner; the said wick being protected and capable of absorbing and raising the carburetting liquid, as described. Second,—the employment of a current of air between the carburator and the tube leading to the burner, as described. Third,—the employment of two currents of gas, one of which is carburetted, as herein-before described, while the other is ordinary coal gas, and passes direct to the burner, where both currents are consumed together, as described."

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*To RICHARD ARCHIBALD BROOMAN, of Fleet-street, for improvements in apparatus for carburetting gas,—being a communication.*—[Dated 14th October, 1862.]

THIS invention of improvements for carburetting gas may be divided into three parts, consisting, first, of a vessel for containing the carburetting liquid; second, of the carburator proper, fed by the first-named vessel; and, third, of certain valve and tap arrangements.

In Plate I., fig. 1 is a longitudinal section of an apparatus for carburetting gas, constructed according to this invention. *A*, is the vessel containing the carburetting liquid, and *B*, the carburator proper. The reservoir *A*, is placed above the carburator *B*, and can be removed to be supplied with liquid. This reservoir, when charged with liquid, is hermetically closed by a stopper *b*, entering the part *c*, and covered with packing *d*, which makes a tight joint in the cap *e*, which is screwed on to the part *c*. The reservoir *A*, communicates at bottom with the carburator *B*, by a tube *f*, the mouth of which is covered by metallic cloth *g*, to filter the liquid as it flows out. The reservoir is supported on feet *h*, which rest on the carburator, and the feet fit over it. There is an air tube *j*, leading from the carburator *B*, to the reservoir *A*, passing, when the latter is fixed to the carburator, by preference through one of the feet *h*, and extending to near the top of the reservoir; but when the reservoir is not attached to the carburator, the air tube *j*, is replaced by a gas pipe. The carburator is divided by partitions *k*, *k*<sup>1</sup>, *k*<sup>2</sup>, into three compartments, each of which forms a small vessel, the depth varying according to the size of the apparatus. These vessels are fitted with cotton wicks *l*, extending vertically the whole depth, or nearly so, of the apparatus. In the two upper compartments the level of the liquid is regulated by two small tubes *m*, *m*<sup>1</sup>, which carry the overflow from one into the other, and into the lower vessel. There is

a safety compartment D, at the bottom of the carburator, which, through a tube E, receives any excess of liquid that may be produced. The gas, after having passed through a tap of peculiar construction, reaches the carburator B, through a pipe H, and descends, by another pipe I, to the lower part, where, after having traversed in a zig-zag direction the three compartments fitted with wicks, and thus becoming enriched, issues from the apparatus by another pipe H', provided for that purpose. To empty the carburator B, first open the interior taps below the upper vessels; these taps are opened from the outside by a prolongation of the axis o, which fits into the head p, screwed to the side of the apparatus. Where two taps are employed, each of the vessels k, k', is provided with a tube n, or n', leading to one of the taps d, d'. When only one tap is employed, it is furnished with two apertures, each leading to one of the vessels; secondly, to empty the carburator, open two parallel taps placed one on each side at the bottom of the carburator. The carburator n, is fitted at top with a cover B'. The tube f, is connected to the reservoir A, and terminates in an enlarged head f', fitted so as to hermetically close the valve chamber c; the tube f, is fitted at its upper part with a tap s, (see the detached view, fig. 2) which must be closed whenever the reservoir A, is removed; a joint t, screws on to the body of the valve c. The valve proper u, is formed with a conical head fitting into a conical seat; the conical head is formed on a rod u', screwing into a spring v, which exerts a strong pressure from top to bottom, and thereby keeps the valve closed. A weighted float P, connected to a lever q, free to oscillate upon a fixed point, imparts to the valve u, u, an upward motion, and exerts sufficient power to overcome the resistance offered by the spring v, whereby the valve is opened, and passage is allowed to the carburetting liquid until a certain level is attained in the vessels in the carburator B; then the float, in rising, ceases to keep the valve closed, when the spring v, acts to keep it on its seat, and thereby closes and stops communication between the carburator and reservoir. A float is used for indicating the level of the liquid in the reservoir. The rod h', of a float f', (see fig. 1) is attached at its extremity to a pointer g, of the scale l. The top of the reservoir A, is raised at l', to receive the float f', when the reservoir is quite full. There is also a recess or cavity m', at the bottom of the reservoir, to receive the float when the reservoir is quite empty. This arrangement gives a correct indication of the level of the carburetting liquid in the reservoir. The reservoir A, may be replaced by a glass vessel A', (fig. 3) fitted with necks T, T', at top and bottom. The upper neck serves for the introduction of liquid into the reservoir A', and is closed by a glass or metal stopper y. A copper pad z, divided into two parts, embraces the neck of the vessel A', and receives a screw cap z', into which a metal top z'', is screwed. The lower neck T', allows the passage of liquid to the valve u, before described, and is surrounded by a metal ring w, also divided into two parts, which presses against the fitting on the edge of the neck, and screws into the interior of the body of the valve c, similarly to that before described. The air tube j', in this arrangement passes through the valve, and acts as a guide to it. A four-way tap B, is fitted to the carburetting apparatus (see figs. 3 and 4), by which the gas is conveyed. The two passages 1, and 4, of the tap are for the supply of the gas, and the other two passages 2, and 3, are for leading it to the carburator. The key s, has six openings, 1', 2', 3', 4', 5, and 6, in pairs.

together,—making three passages. In the section fig. 4, the tap is shown open to the carburator; the gas enters by 1, 1', 2', and 2, into the carburator B, and passes out by 3, 3', 4', and 4. To reverse the tap, turn the key *s*, so that the opening *e*, may correspond with the passage 1, for the admission of gas, and the opening 3, with the passage 4, for the exit of the gas; the passages of the carburator are thus closed by the full parts of the key *s*.

The patentee claims, "the improvements in apparatus for carburetting gas, hereinbefore described."

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*To WILLIAM RENWICK BOWDITCH, of Wakefield, Yorkshire, for improvements in carburetting or naphthalizing gas, and in the apparatus employed therein.*—[Dated 31st October, 1862.]

THIS invention consists in applying heat to vaporize the hydrocarbons employed for carburetting or naphthalizing gas for illumination, and in passing gas, before it is burnt, through or over the heated hydrocarbons; also in heating the hydrocarbons, and keeping the volatile products hot by the gas flame itself; and in improved apparatus to be used for the above purposes.

The figure in Plate I. is a section of the improved carburator. *a*, is a gas-tight vessel, of any suitable form or size, having an inlet and outlet pipe for the gas. The inlet and outlet pipes are so placed, that the gas, in its passage through the vessel, must pass over the surface of its contents. This is called the vaporizing vessel. It is advantageous to bend the pipes inside the vaporizing vessel, as shown at *H*, in order to prevent the contents of the vessel getting into the pipes while the apparatus is in use. The part bent over should be from an inch and a half to two inches long. The vaporizing vessel is charged through an aperture *o*, which is closed gas-tight by a screw plug. This aperture is so placed, that when the vessel is in the position shown, and is as full as it then can be made, there is a space of about half an inch between the apertures of the inlet and outlet gas pipes and the surface of the hydrocarbon contained in the vessel. *N*, is the inlet pipe. The outlet pipe, which conveys the gas and vaporized hydrocarbons to the burner, is bent, as shown at *I*, three or four inches above the burner, so that a part of it, as well as the vaporizing vessel itself, may be heated by the gas. This heating of the outlet pipe prevents condensation. When using the apparatus, the inlet pipe is attached to a pipe which supplies the gas about to be burnt, and some hydrocarbon is put in the vaporizing vessel and the aperture is closed. The gas is then lighted, and the heat thus produced converts part of the hydrocarbons into vapour. The passing gas carries this vapour from the vaporizing vessel to the burner, where the gas and vapour are consumed together, the illuminating power of the gas being thereby greatly increased. Any kind of illuminating combustible gas may be used with this apparatus, but common coal gas is preferred. Instead of employing the heat produced by burning gas to vaporize the hydrocarbons used for carburetting gas (as above described), any other convenient source of heat may be used. Whatever be the source of heat, it is necessary to have the vaporizing vessel placed near the burner, as heavy hydrocarbons condense easily, and obstruct the flow of gas. This is especially the case with naphthaline

The outlet pipe should always be kept as hot as the vaporizing vessel, and in all cases it is preferred to have this vessel and part of the outlet pipe placed above the burner. In this position it casts no shadow, and the heavy vapour of the hydrocarbons passes more easily and regularly to the burner. A greater or less amount of illuminating power may be obtained from gas treated as above, by heating the vaporizing vessel more or less as required. The amount of heat may be increased or decreased by varying the quantity of gas burnt, or the distance between the burner and the vaporizing vessel. The distance between the burner and the vaporizing vessel may be regulated by means of a long thread upon the outlet pipe *I*, as shown at *K*. Instead of having a moveable burner, a fixed burner is preferred, and a false bottom is applied to the vaporizing vessel, which can be placed at any desired distance from the true bottom of the vessel, and between that bottom and the gas flame, or can be removed entirely. This sufficiently regulates the heat applied, and gives no trouble. The false bottom is shown at *L*, or it may be of any form found convenient. When in use it may be supported by small projections *M*, on the side of the vaporizing vessel, or in any other convenient manner. To reduce or increase the quantity of hydrocarbons vaporized in a given time, the false bottom is moved farther from or nearer to the bottom of the vaporizing vessel. The vessel must be replenished with hydrocarbons from time to time, as required. The hydrocarbons preferred, on account of their cheapness, safety, and easy use, are those obtained by the distillation of gas tar, known as heavy naphtha, "dead oil," and "naphthaline." Hydrocarbons which boil below 250° Fahr., are not so well adapted as those for use; they are generally vaporized so rapidly as to supercharge the gas with their vapour, and thus produce smoke in burning. Those hydrocarbons are preferred which have about the same density as water, and dissolve in them as much naphthaline as they will retain in solution at ordinary temperatures. The hydrocarbons should be properly purified, before use, by any of the well-known methods. They afford a brilliant light when used crude, but then have an offensive odour, and yield injurious products of combustion. Rock oils, shale oils, rosin oils, camphines, and other hydrocarbons may be used in this apparatus, but with less economy.

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*To LOUIS PIERRE MONGRUEL, of Paris, for an improved cold vapour generator, which may also be used in the carburation of illuminating gas.—*  
[Dated 17th March, 1862.]

IN Plate I., fig. 1 is a vertical section, and fig. 2 is a horizontal section, of the improved generator. The apparatus is divided into two chief parts; the upper part forms a reservoir for liquid, and the lower part forms a vapour chamber in which the volatile liquid is placed. *a*, *a*, is the casing of the apparatus; *a*<sup>1</sup>, the cover; *b*, the intermediate bottom separating the two compartments *c*<sup>1</sup>, and *h*; *b*<sup>1</sup>, lower bottom of concave form, and pierced in the centre by a hole *b*<sup>11</sup>, of somewhat less than half an inch in diameter, and funnel shaped; *c*, is a plug by which the liquid is introduced into the apparatus: this plug is surmounted by a hexagonal head, which permits it to be closed by a key, and is provided at the pressure point with a leather washer. This might be replaced by an emiered stopper, if the apparatus is of glass or a similar substance. In all cases it is surrounded



by a basin forming a hydraulic closing.  $c^1, c^1, c^1, c^1$ , upper compartment or chamber serving as reservoir for the liquid;  $d$ , float of leaded copper or other material, intended to denote the height of the liquid in the upper reservoir; it is pierced in the centre, and surmounted by a tube  $d^1$ , the length of which, added to the thickness of the float, equals the height of the reservoir  $c^1$ , plus the difference resulting from the thickness of the neck of the plug.  $d^{11}$ , rod fixed perpendicularly to the bottom  $b$ , in the axis of the plug  $c$ , serving to guide the float, through which it passes and enters the tube  $d^1$ ;  $e$ , tube covered at its upper part by the plug or stopper  $g$ , passing through the partition  $b$ , to which it is hermetically fastened, and plunging into the chamber  $h$ , to a depth of about an inch;  $f$ , float of leaded copper or other material, which indicates the height of the liquid resting on the bottom of the vapour chamber  $h$ ;  $g$ , rod fixed to the float  $f$ , entering the tube  $e$ , and rising above the upper orifice of this tube  $e$ .  $g^1$ , plug or stopper, by which the upper orifice of tube  $e$ , is closed, to prevent the disengagement of the vapours and gases. This plug may, if desired, be replaced by a glass tube, closed at its upper part, and with its lower part in a circular groove surrounding the tube  $e$ , and forming a hydraulic closing. This latter method permits the elevation of the rod  $g$ , to be constantly seen without unstopping the tube  $e$ .  $h, h$ , lower chamber for disengagement of the vapours: this vapour chamber is divided into three compartments.  $i, i$ , compartments reserved for the introduction and exit of the gaseous or atmospheric current, and the working of the floats;  $j, j, j, j$ , compartments reserved for the arrangement of wicks  $k, k^1$ ;  $j, j^1$ , partitions forming the division of the chamber  $h$ : these partitions are fixed by their extremities to the apparatus, and their upper parts are pierced with holes, the number of which increases progressively from top to bottom.  $k$ , arrangement of capillary textile wicks, interlaced in the meshes of two wire gauzes, superposed and held apart by the uprights: it completely fills the compartment  $j, j, j, j$ .  $k^1$ , wicks of this arrangement plunging into the liquid  $l$ , raising it by capillary attraction, and multiplying the vaporizing surfaces;  $l$ , the liquid intended to produce the vapours, and constantly feeding the gaseous or atmospheric current, without change of level;  $m$ , wire gauze grating, with meshes of about  $\cdot 03937$  parts of an inch, the object of which is to oppose the introduction into the tube  $n$ , of any foreign bodies which might be contained in the liquid;  $n$ , tube by which the liquid descends from the reservoir  $c^1$ , into the chamber  $h$ , ground at its lower orifice, and funnel-shaped at its upper part;  $o$ , float, surmounted by a rod, with conical base and forming a valve: its object is to close hermetically the lower orifice of tube  $n$ , and arrest the flowing out of the liquid as soon as it has attained its normal level.  $o^1$ , hollow beneath the bottom  $b^1$ , to receive the thickness of the float  $o$ ;  $p$ , gutter or conduit of communication between the basin  $o^1$ , and the condenser  $p^1$ ;  $p^1$ , basin of the condenser, placed beneath the bottom  $b^1$ , intended to receive the impurities and the aqueous particles contained in the liquid or in the gases which pass through the chamber  $h$ : it is put in communication with this chamber by the opening  $\delta^{11}$ , made in the centre of the bottom  $b^1$ . A tap for running off the liquid condensed in the basin  $p^1$ , and which forms part of the invention, is composed of four parts,—firstly, the chamber or barrel, with its horizontal socket or tube united to the basin  $p^1$ ; secondly, the cone surmounted by a head or nut with several sides, which permit of its being turned with a key; thirdly,

a basin or well, closing with screw the lower part of the barrel or chamber, to prevent any leakage of the liquid; fourthly, and lastly, a cap, also screw-fastened, and closing the upper part of the barrel or chamber, to render any exterior volatilization of the liquid impossible. These two last parts have, like the cone, a head or nut, which permits of their being tightened by a key; they are also furnished with leather washers at the point of pressure. There is an air tube, intended to equalize the pressure between the two chambers  $c'$ , and  $h$ : this tube, the upper orifice of which is placed about the sixth of an inch from the cover  $a'$ , traverses the intermediate bottom  $b$ , to which it is hermetically fixed, and descends into the chamber  $h$ , to the level of the orifice of the tube  $n$ . A valve, applied to an air tube, permits any excess of vapours which might be disengaged from the liquid contained in the reservoir  $c'$ , to descend into the chamber  $h$ , so as to maintain the equilibrium between the two chambers: this valve only acts in case the liquid rises to the lower orifice of the air tube.  $s$ , are tubes serving either for the entrance or exit of the gas; they are put in communication with each two of the compartments  $i$ . In operating with the apparatus, the liquid descends from the reservoir  $c'$ , by the tube  $n$ , and spreads over the surface of the bottom  $b'$ , up to the level indicated by  $l$ . The air or gaseous body contained in the chamber  $h$ , as this descent takes place, rises by the air tube above the liquid contained in the reservoirs,—the vapours which may form in this reservoir also descending into the chamber  $h$ , so as to produce a constant equilibrium; but as soon as the liquid  $l$ , has attained its level, the conical base of the rod of the float  $o$ , hermetically closes the tube  $n$ , by reason of the pressure of the liquid which has descended, and thenceforth all circulation is arrested in the tube  $n$ , and the air tube: but as the gaseous or atmospheric current, entering by one of the tubes  $s$ , and issuing by the other, carries off vapours, new vapours are formed at the expense of the liquid  $l$ , the level of which lowering frees the conical stem of the float  $o$ , and permits the liquid to descend by the tube  $n$ , so that the level of the liquid  $l$ , is constantly and by a natural law maintained at the same height.

The patentee claims, "the apparatus above described as a whole, together with the arrangement of the several parts, essentially as set forth."

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*To CHARLES MERTENS, of Gheel, Belgium, for improvements in machinery or apparatus for scutching and dressing flax, hemp, or other fibrous materials.*—[Dated 22nd September, 1862.]

IN Plate II., fig. 1 shows an end view, and fig. 2 a transverse section, of a machine, suitably arranged for scutching and dressing flax, hemp, or other fibrous materials, according to this invention. Fig. 3 shows several views of the clamps, or hinged spring holders, for holding the flax or other fibrous material whilst being operated upon by the revolving beaters.

The machine consists of two shafts  $A$ ,  $B$ , which are supported by, and turn in, suitable bearings fixed to the framing, and are geared together by the toothed wheels  $C$ ,  $C$ , of equal size. Each shaft carries four or other suitable number of curved arms or wings  $D$ , and sheet metal, of similar contour to the iron arms  $E$ , is attached thereto, in order to close, or partly close, the spaces between the arms  $E$ , fixed at each end of the shafts  $A$ ,  $B$ . The metal arms  $E$ , are fixed on square bosses  $F$ . By the

rotation of the shafts the curved arms or wings are carried round, and cross each other's course without touching. Each wing or arm carries at its end, along its entire length, and parallel or nearly parallel to the axle, a beater *G*, of wood or other hard material, which, at the entrance, or that part of the machine where the flax first enters, is of a round or blunt form, and gradually diminishes to an edge or angular shape towards the outlet or opposite end. To each wing of the axle *B*, there is fixed upon the hollow side a lining of wood *P*, which causes the flax to be rubbed against this lining of wood by the beaters of the shaft *A*, during their revolution, and thus greatly facilitates the scutching process. The pieces of wood *P*, are parallel to the axis, and about the same length as the comb *G*<sup>1</sup>. These pieces may also be fixed in such manner that they may spring slightly in case it should be wished to cause them to come in contact with the beaters of the shaft *A*, to give still more effect to the scutching process by producing a rubbing action; or the springing action may be imparted to the arms of the other set of beaters. For some purposes one or several of the arms or wings of the shaft *A*, may be provided with a toothed piece *G*<sup>1</sup>, made of wood or other suitable material, which acts as a comb to open the ends of the fibrous material during the scutching process. Whilst the fibrous material is engaged between the scutching plates of the machine, it is beaten on both sides simultaneously, and it travels from the entrance of the machine (where it is placed by hand) to the outlet, whilst being firmly held between spring clamps or holders *Q*, made, by preference, of wood, strengthened with iron plates; which clamps or holders are opened and closed, when out of the machine, by means of levers, as hereafter described. The fibrous material thus held between the clamps or holders *Q*, is conducted, by means of an endless chain *q*, which communicates motion to the clamps or holders by means of a toggle or projection on the holders taking into the length of the chain. The endless chain receives motion from the axle *A*, by means of the pulleys *M*, *N*, and the clamps or holders are supported and moved along upon the two parallel bars *O*, fixed to the framing of the machine. As the flax leaves the machine, it passes before a beater, furnished with wings or blades *R*, (see fig. 1) which beater receives motion from the axle *B*, by means of the pulley *S*. This beater, by its blades or wings, is caused to strike against the fibrous material in its passage outwards, by which the fibres are laid parallel and even. The beater *R*, is fixed by supports to one of the bars *O*. Upon the shaft *A*, the pulleys *T*, are fixed, one of which gives motion to the machine. *u, u*, are covers of sheet iron, which cover and enclose the mechanism of the curved wings *D*.

Fig. 3 shows side and end views of the clamps or holders *Q*, which hold the fibrous materials whilst being operated upon. One end of each holder is formed with a strong hinged joint 1, the other (or open end) is furnished with a sliding bolt and locking plate or catch, as seen at 2. In order to close the holders with the fibrous material therein, the two open ends have to be pressed together by means of a lever (preferred to be mounted on the table on which the holders are filled), so that the sliding bolt can be slid into the catch plate, and thus the parts are securely held together. The clamps have a pin or projection 3, in the middle along their entire length in one jaw, and a groove in the other jaw, for better holding the material. There are also two flanges of iron 4, to support the clamps upon the bars *O*, and at the middle, upon one of these flanges, is fixed a toggle 5, which takes into the links of the endless chain.

*To THOMAS GREENWOOD, of Leeds, for improvements in machinery for preparing to be spun flax, hemp, tow, silk waste, China grass, and other fibrous substances.*—[Dated 22nd October, 1862.]

THE object of this improvement is, first, to expedite the operation of dressing waste silk and China grass without injury to the material. This is effected by applying a variable speed to the comb sheet, and thereby increasing the speed and action of the combs as the dressing process proceeds. This variable or progressive speed can be accomplished with more or less advantage in various ways. Thus, a disc plate, driven by a bowle, may be used, or a pair of cones with a traversing strap, varied in position either by hand or by means of a self-acting motion, in conjunction with the rising motion of the in-frame which holds the "books" or clamps in which the materials to be dressed are secured; or two or more speeds may be applied to the driving shaft of the machine, with a lever and clutches, changeable by the operator at pleasure; or the variable or progressive increase of speed of the comb sheet may be combined with different speeds of the driving shaft, for expediting the dressing operation.

In Plate II., fig. 1 represents so much of a silk dressing frame as is necessary to explain this part of the invention. A, A, is the main framing of the machine; B, is the driving shaft, supported in suitable bearings attached to the framing A, A, and carrying a pair of belt pulleys at its outer end. Keyed to the inner end of this shaft is a bevil wheel which takes into a similar wheel on the lower end of a vertical shaft C, which turns in bearings projecting from the main framing. This shaft C, carries a friction bowle D, the boss of which is fitted with a key that slides in a suitable groove in this shaft. The use of this bowle is to drive, by friction of contact, a disc plate E, which communicates motion to the endless sheet of combs employed in dressing the waste silk. This disc plate E, is mounted upon a stud fixed in the framing A, and has a pinion upon its boss which takes into a spur wheel F, also mounted on a stud fixed in the framing A. Upon the boss of this wheel F, is a pinion, which takes into a spur wheel G, keyed to the axle of the ordinary sheet roller H, of the dressing frame. I, is a vertical sliding piece, mounted in bearings attached to the framing A, and formed with a projection terminating in a fork, which embraces the bosses, and thereby serves to support the friction bowle D, in position on its shaft C. On the opposite side of this sliding piece I, is a projection J, which extends over the in-frame K, and is caught by this frame during its rising motion, and carried upwards with it, thereby causing the friction bowle D, to rise towards the centre of the disc plate E, and impart an accelerated motion thereto, and consequently to the sheet roller H and combs carried by the sheet. The in-frame K, which carries (as is well understood) the "books" or clamps which hold the silk to be dressed, is raised by the rotation of cams L, up to the action of the combs, and thus, slowly rising, reaches the projection J, and lifts the slide together with the bowle D. The bowle thus raised gradually nears the centre of the disc E, and thereby proportionately increases the speed of its rotation, which increased speed is communicated to the endless sheet of combs; the advantage of this progressive accelerated speed being to pass the combs the more quickly through the silk as the combing and straightening process proceeds.

The second part of the invention relates to a novel method of fixing

the heckles, gills, or combs to the bars or fallers used in machines for preparing flax, hemp, or other fibrous substances. Hitherto these gills have been rivetted or screwed on to the upper edge of the bars or fallers, by which process the bars or fallers are considerably weakened, in consequence of the holes for the rivets or screws being drilled through them. This improvement consists in fitting the combs or gills into a recess, say of a dovetail shape, cut in the bar or faller, so as to resist the pull of the material when drawn through the combs or gills. The combs or gills can then be held firmly in their places by soldering.

Fig. 2 is a side view of a screw gill faller or heckle bar, showing the recesses cut out to receive the gills or heckles; fig. 3 is a plan of the same, showing the manner of cutting the dovetail recesses; fig. 4 is a side view, showing the gills or heckles soldered in their places; and fig. 5 is an edge view of the same. The arrows show the direction in which the sliver is drawn, and the resistance offered by the dovetail shape of the ends of the heckle or gill stock. *a, a*, is the gill bar or faller; *b, b*, are the recesses cut to receive the heckles or gills; and *c, c*, are the heckles or gills, which fit the recess, and are held firmly in their places by soldering.

The patentee claims, "First,—imparting a varied and accelerated speed to the combs of silk-dressing machines as the process proceeds, for the purpose above described. Secondly,—the mode, above described, of fixing heckles, gills, or combs to the bars or fallers used in machines for preparing to be spun flax, hemp, tow, silk waste, China grass, or other fibrous substances."

*To JOHN MCKEAN, of Walmer Bridge Mills, near Preston, and THOMAS GREENALL, of Manchester, for improvements in sizing or dressing yarns or textile materials.*—[Dated 4th November, 1862.]

THIS invention relates to the use of a novel composition for sizing or dressing and preparing warp yarns for the loom. The basis of this composition is China clay, kaolin, or other similar silicious or aluminous earths, and such clays are rendered available for use in the treatment of warp yarns by admixture with the products obtained from farinaceous or amylaceous matters, such as wheat, rice, potatoes, sago, tapioca, salop, &c., by treating the same with sulphuric, nitric, or hydrochloric acid, and afterwards subjecting it to a temperature varying from about 300° Fahr., in a manner similar to that employed for the production of gum substitutes, as is well understood; the degree of temperature employed being dependent on the product which it is desired to obtain. The materials may be employed in the proportion of three parts by weight of finely-divided China clay, kaolin, or other similar silicious or aluminous earths, to one part and a half by weight of the products resulting from the before-mentioned treatment of the farinaceous and amylaceous substances.

In addition to the mixture or combination before mentioned, the following has been found suitable for the sizing and dressing of yarns such as are generally employed for the production of woven fabrics:—5 parts by weight of China clay and 4 parts by weight of the farinaceous products. The resulting composition is a perfectly dry and fine flour or

powder, which requires to be simply mixed with water and then boiled, so as to convert it into a paste of suitable consistency for use.

The patentees claim, "First,—the manufacture of the peculiar compounds or compositions hereinbefore described, to be employed in the sizing or dressing of yarns. Secondly,—the application and use of the peculiar compounds or compositions, hereinbefore described, in the sizing or dressing of yarns."

*To ROBERT RAYNSFORD JACKSON and ÆMILIUS IRVING JACKSON, both of Blackburn, Lancashire, for improvements in machinery for cutting fibrous and other materials.*—[Dated 24th September, 1862.]

THE object of this invention is to provide an efficient machine for cutting fibrous material into short lengths.

The invention consists in certain modifications of machines which have been mostly used hitherto for cutting paper, such machines consisting of a knife, which has either a vertical or a compound vertical and lateral movement; but a diagonal cut is preferred. The knives in these machines cut against or into lead or other soft metal or material.

In Plate II., fig. 1 is a longitudinal section, and fig. 2 is a front view, of a machine made according to this invention; fig. 3 is a back view of a part of the machine; and fig. 4 is a side view of part of the machine. A, is the framing of the machine; *a*, first motion shaft; *a*<sup>1</sup>, fast-and-loose driving pulleys; *a*<sup>2</sup>, fly wheel; *a*<sup>3</sup>, pinion on shaft (*a*), driving the wheel *b*<sup>1</sup>, on the intermediate shaft *b*. On this shaft a pinion *b*<sup>2</sup>, is secured, driving a wheel *c*<sup>1</sup>, on a shaft *c*, at each end of which a crank *c*<sup>2</sup>, is secured, which cranks are connected by rods *c*<sup>3</sup>, to the knife bar *d*, which slides in vertical guides in the framing. The knife bar *d*, is made to move diagonally, by means of a stud which is fixed in it, which stud carries an antifriction bowle that fits in a diagonal slot *d*<sup>2</sup>, in the cross bar *d*<sup>3</sup>, (seen best in fig. 3), so that the movements of the knife are both vertical and lateral at the same time. The crank shaft *c*, has an end movement (in agreement with the lateral movement of the knife bar *d*), which is imparted to it by a cam *c*<sup>4</sup>, secured to the shaft *c*; and into the path of this cam enters an antifriction bowle, carried on a stud fixed in a bracket *c*<sup>5</sup>, secured to the side frame; so that as the bowle is fixed, the cam, revolving by the rotation of the shaft, forces the shaft endways, in agreement with the side movements of the knife bar *d*. *e*, is a lattice of any required extent, which carries forward the material drawn from the laps *x*, arranged as shown in fig. 1. The material passes through fluted rollers *f*, *f*, which gear with bevil wheels on a vertical shaft *f*<sup>1</sup>, carried in suitable bearings from the framing. The lower wheel on the vertical shaft is fixed, the upper one slides on a fixed key, the boss of the wheel being grasped by a forked part from the bearing of the upper feed roller, so that the wheel is moved up and down by the movements of the roller. The upper roller is weighted by levers *f*<sup>\*</sup>, each having its fulcrum on a stud *f*<sup>2</sup>, in the framing, and from these levers rods *f*<sup>3</sup>, ascend, which are bent at their upper ends, so as to come upon the top side of the bearings of the upper roller. The lattice *e*, receives motion by being geared with the lower feed roller by wheels *e*<sup>1</sup>, the pitch lines of which are shown in fig. 4. Intermittent motion, for feeding the material, is given to the fluted rollers by

a cam piece  $c^6$ , secured upon the side of the wheel  $c^1$ ; this acts upon the howle carried by an arm  $g^1$ , from a shaft  $g$ , and this arm is weighted by another arm  $g^2$ , so as to cause the shaft to turn, when not otherwise acted upon, till the finger  $g^3$ , (shown in fig. 4) comes against a pin or stop  $g^5$ , in the framing. Upon the outside end of this shaft  $g$ , an arm is fixed, which is connected, by means of a rod  $g^6$ , with an arm  $g^7$ , centred and free to oscillate on the end of the lowest feed roller. This arm carries a click, which works upon a ratchet wheel  $g^8$ , secured upon the end of the feed roller, and thus movement is imparted to feed the material after each cut. The knife cuts into a piece of wood or lead, which is kept in its place, in a recess formed in the upper side of the cross bearer  $a^1$ , by a bar, which is adjustable against the strip of lead or wood, by means of screws. The material is lifted from the incision, made by the knife, by the spring-plate  $k$ , which extends across the machine; this spring-plate is pressed down before each cut, and lifts when the pressure is removed. In place of the spring, a lever plate may be used, the fulcrum or shaft from it being brought to the outside of the framing, and weighted by means of an arm and weight; or the arm may be arranged so as to be acted upon by an incline upon the knife bar, which will act upon the lever as it ascends, and will cause the front edge of the plate to be lifted, so that the material may be detached from the incision. The material is pressed down by means of a bar  $k$ , extending across the machine, the ends of the bar working in guides formed by ribs upon the side frames. This presser bar is cast hollow, and is actuated by two studs fixed in the knife bar, which work in slots carried in the hollow presser bar, as shown in fig. 3. It will be seen, that as the knife has both vertical and lateral movement, and that as the presser bar is only capable of moving vertically, the studs in the knife bar will impart its vertical movement to the presser bar  $k$ , as long as they are in the horizontal part of the slots; but when, by lateral movement, they arrive at the diagonal parts of the slots, which are at the same angle as that for giving the diagonal movement to the knife bar, the presser bar will become stationary. The slots in the presser bar  $k$ , are made in separate pieces, so as to fit into the hollow presser bar between the top and bottom rib, and be capable only of side movement; and the position of each slot is adjusted by a screw  $k^2$ , screwing through a nut connected with the slot piece, and acting against studs or collars fixed in the hollow presser bar, as shown in fig. 3: the slot pieces are kept in their places, when adjusted, by means of set screws  $k^3$ , passing through slots in the hollow presser bar, as shown. The under side of the presser bar, when up, is a little in advance of the edge of the knife, and the slots are adjusted so that the knife and presser bar descend together till the material is sufficiently compressed, at which moment the studs have arrived at the diagonal part of the slots; the presser bar then remains stationary, and the knife descends alone, and makes the cut: when the knife ascends again, it lifts the presser bar, when the studs arrive at the horizontal part of the slots, and then the material is fed forward for the next cut. The presser bar may be weighted against the material and lifted by the ascent of the knife bar, by means of the studs or their equivalents.

The patentees claim, "Firstly,—the combination and arrangement of mechanism for cutting material into lengths, as described. Secondly,—the system or mode of detaching the ends of fibrous material from the

incision made by the knife by the mechanism and arrangements described. Thirdly,—the system or mode of pressing upon the material to be cut, by a presser bar, arranged and actuated in the manner described. Fourthly,—the use of the spring-plate *k*, or its equivalent, or the presser bar *k*, acting in the manner described, in machines for cutting fibrous and other material, when the knife cuts past another fixed knife or other edge.

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*To EDWARD HUMPHRYS, of Deptford, Kent, for improvements in the construction of centrifugal pumps.*—[Dated 3rd November, 1862.]

IN manufacturing rotary or centrifugal pumps, it has hitherto been the practice to cast the case either in two pieces, with the joint vertical to the axis of the wheel spindle, or to cast the case in one piece. In the former mode of manufacture the wheel cannot be introduced or removed without separating the vertical joint, and in the latter two man-holes, with their doors, have to be provided,—the one for the admission or removal of the wheel, and the other for the admission of a cutter to face up that part of the case which forms the extremity of the two suction pipes, to enable the wheel to work smoothly therein, and of the nut for securing the wheel on its spindle: these arrangements are therefore inconvenient and disadvantageous. Heretofore, also, the wheel has been made separate from its spindle, and has afterwards been keyed thereon. This construction entails a good deal of labour and expense in fitting.

Now this invention consists in casting the case in two pieces,—the joint being made in a line passing horizontally through the axis of the wheel spindle and its stuffing box; and in casting the wheel and its spindle in one piece. In this manner the use of covers is avoided, the fitting is simple and easily accomplished, and in consequence of the line of the joint passing through the axis of the wheel spindle, the wheel is readily introduced or removed when necessary, the upper part of the case being unbolted and lifted for the purpose.

In Plate II., fig. 1 is a transverse section of a rotary or centrifugal pump case constructed according to this invention, and fig. 2 is a plan of the lower portion of the pump case. The pump case is cast in two parts, which are fitted together at the line *x, x*. The two surfaces to make the joint are planed or faced truly, and for this purpose but one setting of each piece in the machine is necessary; this being done, the internal projection at *A*, in each casting, is chipped and filed accurately to a half circle concentric with the general form of the casting. The two castings are now bolted together, so as to bring the two semicircles true, the one with the other, and the case is set in a lathe for boring the central hole to receive the bushes *B, B*, and the gland *C*, of the stuffing box. The boring is effected by means of a self-acting boring bar, one end of which fits and runs truly in the hole at *A*, and the other is bolted to the revolving face plate of the lathe. The bushes *B*, are made of brass and lined with lignum vitæ; *D, D*, are pipes to maintain a flow of water through the bearings. The portions of the case at *E, E*, which form the extremities of the two suction pipes, and between which the wheel fits accurately, are faced by a cutter actuated by the boring bar. Fig. 3 shows a section of the wheel and its spindle. These parts are cast in



one piece; the spindle is turned where it enters the bearings, and the wheel is faced on the two sides, where it works in contact with the case at E, E.

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*To JOSEPH SHIRT and CHARLES BRIGGS, both of Tamworth, Staffordshire, for improvements in apparatus for condensing the steam of high-pressure steam engines.*—[Dated 4th November, 1862.]

FOR the purpose of condensing the steam of high-pressure steam engines, an air-tight vessel is applied to the exhaust pipe of the engine. Above the point where the exhaust pipe is applied to the vessel there is a perforated partition, or other provision is made for dividing the condensing water into numerous streams. The condensing water is introduced by a pipe, at the upper part of the vessel, from a cistern or otherwise, so as to keep up a constant supply, which may be regulated by a valve. From the lower part of the vessel a waste water pipe descends, the lower end of which is constantly covered with water in a cistern. The exhaust steam flows from the steam engine into the air-tight vessel, and is there condensed, whilst the steam in the engine acts on the piston, which on the other side is subject to a partial vacuum.

The figure in Plate II. represents a vertical section of apparatus arranged in a suitable manner for carrying out this invention. *a*, is the air-tight vessel; *b*, the eduction pipe from a steam engine; *c*, is the water supply pipe, having a regulating cock *d*, thereon; *e*, is a perforated plate, by which the water is divided into numerous streams; *f, f*, is the waste pipe or hydraulic column communicating with the hot well *g*, having an outlet *h*. The length of this waste pipe or hydraulic column *f*, will vary, depending on the situation of the steam engine, the supply of water, and the extent of vacuum desired. It is preferred that this column should be about thirty feet in height, but considerable advantage is said to have been derived from using a pipe of much less height.

The patentees claim, "the combination of condensing apparatus, such as herein explained, with steam engines, as described."

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*To JAMES OXLEY, of Frome, Somersetshire, for improvements in apparatus for separating liquids from substances.*—[Dated 18th November, 1862.]

THE substances to be operated on are placed in an air-tight vessel, connected with an air-pump, by which atmospheric air is forced into the top part thereof. The air being thus compressed above the semi-fluid substances, gradually drives the latter through a pipe leading from the lower part of the vessel to a chamber placed near, containing a number of cloths folded like bags, having wire sheets or perforated plates, or both, between them, so that each pair of cloths is separated from others by the wire sheets or perforated plates. The effect of this arrangement is, that the semi-fluids flow under the pressure of the compressed air into the centre of the cloths or bags, and by means of this pressure the liquid is expelled through the texture of the cloth, so that it runs away by the wire sheets or perforated plates, and out through the bottom of the box, leaving behind the solid residuum in the cloths.

The vessel is made cylindrical, and of strength sufficient to resist the greatest pressure which may be required to be used therein; it is fitted with a safety valve, capable of being weighted to the extent desired, and is also formed with a manhole, to facilitate the cleansing of the interior. In communication with the upper part of this vessel is the air-pump, by which a constant pressure of air is kept up. The pressure of the air forces the semi-fluid out of the vessel through a pipe leading from the bottom of the vessel to the filter cloths and the apparatus used therewith. The semi-fluid matters to be treated may be supplied to the vessel by a force pump, or be run from a cistern, or otherwise, into this vessel by a suitable pipe, in which case an air cock or valve may be used, for the purpose of allowing the air to escape from the vessel when it is being filled with the semi-fluids. It is preferred that each filter cloth should be of such dimensions as to be folded into the shape of a bag, though each bag may consist of two cloths laid together. The bags so formed should have no seam at the edges, but admit of the cloths being readily unfolded and opened out, in order that the contents may be at once removed after the cloths have been used. The end of the pipe leading from the bottom of the vessel has as many nozzles or outlets as there are bags, and the end of each nozzle is inserted into the end of a bag between the two surfaces of cloth of which each bag is composed. Between each pair of neighbouring bags a sheet of open wove wirework, or of other material, or a perforated plate is placed, so as to separate the bags one from the other; or a perforated plate and wirework may be both used, and thus allow of the fluid which passes through the cloths of which the bags are composed flowing away through the interstices of the open wove wirework, and thence into the lower parts of the chambers in which the bags are contained, whence the fluid is allowed to run into any receptacle that may be placed for the purpose. It is preferred that the plates of wirework, or the perforated plates used between the bags, should have a frame or thickened margin formed around them, or that the edges of the cloths should be slightly folded inwards. This arrangement serves to keep the cloths or bags, when set up, in their places, and to divide out the space intended for and allotted to each. The bags, when shut within the box or chamber, are to be securely fastened therein, in order that they may be capable of resisting the internal pressure caused by forcing the semi-fluids into them. In order to save time in the working of these machines, a strong division is placed between the bags, so as to divide the chamber into two compartments, to enable the workmen to remove the bags from one part whilst the pressure from the cylinder keeps the bags, or other part, in operation. It is preferred that the bags should be placed vertically, as by such arrangement the fluid can more freely descend between the neighbouring bags. By these means the more solid residuum will be left in the bags, the fluid escaping through the cloths of which the bags are composed. The thickness of the cakes of the solid or residuum matters will vary according to the nature of the substances to be operated on.

The patentee claims, "the method above described of separating liquids from solids, by supplying and forcing the semi-fluids into the filtering apparatus by the pressure of air acting within the vessel from which the same are forced into such apparatus."

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## Scientific Notices.

### INSTITUTION OF CIVIL ENGINEERS.

(Continued from page 359, Vol. XVII.)

May 5, 1863.

The paper read was, "*On American iron bridges*," by Mr. ZERAH COLBURN.

THE great number of timber bridges in America might be accounted for from the fact that the first cost of the truss, or superstructure, of a timber bridge of any given span, was generally less than one-half that of an iron bridge of the same strength. Iron had been occasionally employed since 1835, but only within the last ten or twelve years to any extent.

Cast-iron tubular arches, including one of 80 feet span, were erected from the design of Major Delafield, about the time when similar arches were adopted, by the late M. Polonceau, in the construction of the Pont du Carrousel, over the Seine. Major Delafield's arched ribs were elliptical in section, the transverse vertical axis being about four times the length of the conjugate axis. In 1858, an aqueduct bridge was erected at Washington, by Captain Meigs, in which the two arched ribs were formed of water pipes, through which the water flowed. The span of this bridge was 200 feet, the rise being 20 feet. The pipes were circular in section, 4 feet in diameter inside, and  $1\frac{1}{2}$  inch thick. This bridge was 28 feet wide over all, and the roadway was of timber, supported on wrought-iron spandrels. The bridge was tested with the arched ribs filled with water, and with a load of 125 lbs. per square foot upon the roadway, making the total weight on each rib about 350 tons. The thrust of one-half of this weight upon each abutment would be about 470 tons, corresponding to a strain of 2 tons per square inch of sectional area of iron in the pipes. This strain did not include the pressure of the water in the pipes, which were proved to 300 lbs. per square inch. These examples were, so far as the author was aware, the only iron arches yet completed in the United States; and with the exception of a few pivot bridges, and one or two ornamental bridges in the Central Park at New York, they comprise nearly all the cast-iron bridges in that country.

There were a small number of plate or boiler iron bridges. The first was erected in 1847, in place of a timber bridge, by Mr. Millholland, on the Baltimore and Susquehanna (now the Northern Central) Railroad. This was 50 feet span, and the two girders were each 6 feet deep; the two sides of each being formed of plates  $\frac{1}{4}$ -inch thick. Between the sides, at the top, a timber, 12 inches square, was bolted as a compression member, and the top was further strengthened by two wrought-iron bars, 5 inches deep by  $\frac{3}{4}$ -inch thick, while four similar bars were rivetted along the bottom of each girder. The sides were stiffened by stay bolts, enclosed in cast-iron distance pieces, 12 inches apart from centre to centre. The centre of each girder was placed exactly under the rails, which were spiked to the timber forming the compression member. The breaking strain of the pair of girders was

equal to 250 tons of distributed load, and the weight of the bridge was 14 tons. When completed, this bridge was coupled at each end to a railway waggon, and was slung by chains to a temporary timber truss. It was then taken 19 miles by railway, and run exactly over the place it was intended to occupy; the existing timber bridge was cut away, and the girder bridge lowered with the permanent way, ready for traffic; the whole operation not having caused an interruption of more than two hours.

Having been long accustomed to trussed timber bridges, American engineers, in adopting iron, naturally employed it in trusses also. But, before describing the various forms of iron truss bridges, the strength of American iron was referred to. It appeared, from a vast number of experiments made by the United States Ordnance Board, that there was but little iron, in any of the American cast guns, of a less tensile strength than 11 tons per square inch; and in 1851, the author had himself seen portions cut from 11-inch guns, weighing 6 tons 15 cwt., tested up to 16·14 tons. The transverse breaking strength of a large number of samples of re-melted iron, when reduced to the English standard of a bar 2 inches deep and 1 inch wide, resting on supports 8 feet apart, varied from 27½ cwt. to 48·1 cwt., the general strength being 34 cwt. The minimum crushing strength of the irons experimented upon was 37½ tons, and the maximum 77½ tons. Experiments made by the Franklin Institute, twenty-five years ago, showed the mean tensile strength of cast iron, at the first melting, to be 9½ tons; and the iron now employed by engineers in Philadelphia bore from 7·14 tons to 10·2 tons. In 1858, Mr. Albert Fink tested the iron used in the construction of a large bridge on the Louisville and Nashville Railroad. When the results were reduced to bars 2 inches deep by 1 inch wide, on supports 8 feet apart, the minimum breaking weight was 29½ cwt., mean 32·68 cwt., maximum 39 cwt. This iron was a mixture of two-fifths cold blast, two-fifths hot blast, and one-fifth scrap. With regard to wrought iron, the experiments made by the United States Board of Ordnance, gave a tensile strength varying from 17 tons to 33·3 tons per square inch; and those of the Franklin Institute, a mean strength of 26 tons for plate iron. At the present time, 27 tons was generally expected of American boiler plate. Other experiments were also quoted to the same effect; and it was remarked that, from what had been stated, American engineers might work up to rather higher strains than were commonly allowed in this country. The high qualities of the best American iron were due to the purity of the ore and of the fuel employed in the manufacture. In bridges of less than 150 feet span, even when loaded with a weight of 1·34 ton per lineal foot of single line, the strains did not exceed 3·57 tons per square inch on wrought iron in tension, and 4·46 tons per square inch on cast iron in compression.

Of the iron truss bridges that were described, all had certain peculiarities in common, distinguishing them from the trussed structures adopted in this country. In almost every case, the compression members of American iron-trussed bridges were of cast-iron cylindrical or octagonal pipes. These simply abutted, end to end, against each other; and although means were employed to prevent lateral motion of the ends, flanges and bolts were never introduced for that purpose. An-

other, and one of the most important peculiarities, was the depth of truss—a depth exceeding that employed by English engineers, except in rare instances, as at Chepstow, and at Londonderry. American engineers considered a depth of one-eighth, for spans of 200 feet, as only moderate; for shorter spans, depths of one-seventh and one-sixth were common; and in the case of one bridge, of 120 feet clear span, the depth was 23 feet, or nearly one-fifth of the span. It should, however, be observed that, in some of the American trusses, the arrangement of the tension members was such that, if the depth of the truss were not considerable, the diagonals would be inclined at hardly more than  $8^{\circ}$  or  $10^{\circ}$  from the horizontal; in which case a very large quantity of material would be employed, in proportion to the supporting power obtained. No American iron or timber bridges were ballasted; nor had they any floor—only a footpath of planks. In bridges having the rails at or above the level of the top chords, known in the States as “deck bridges,” parapets were seldom employed; and the trusses were often so short a distance apart, that a passenger, on looking out of a carriage window, was unable to discover any support beneath the train. In no bridges, of two or more spans, were the trusses made continuous over a pier; each span being always treated as a bridge by itself.

One of the earliest iron trusses adopted in the States was a trellis, known as Rider's bridge. Cast-iron T or angle irons were employed in compression, and wrought-iron bars in tension. These bridges were so slightly proportioned, that they occasionally broke down, and the author was not aware that the plan was now adopted in new structures.

A detailed description was then given of a Murphy-Whipple bridge, having a span of 125 feet, with the railway supported on the lower chords. It was for a double line, and there were three trusses, 14 feet apart from centre to centre; the strength of the middle one being about one-half greater than that of either of the others. The trusses were 23 feet deep, or 0.184 of the span. The top chord was formed of cylindrical cast-iron pipes, and the bottom chord of a chain of square bars, 10 feet 5 inches in length between the centres of the eyes. Upright cast-iron posts, placed at the same distances apart, divided the truss into panels, and as the posts were in two lengths, they were each trussed by four round rods, to prevent lateral failure. The diagonals were in pairs of square rods, and were formed also as eye bars, grasping pins  $2\frac{1}{2}$  inches diameter in the top chord, where the pipes abutted upon each other, and pins,  $3\frac{1}{2}$  inches diameter, in the bottom chord, thus connecting the links or bars of which it was composed. The diagonal tension bars only crossed each other in two panels, on each side of the centre of the truss. The top and bottom chords were braced horizontally, with transverse and diagonal bars. The railway bars were supported upon longitudinal timbers, which rested upon transverse wrought-iron rolled beams. The total weight of the superstructure complete was  $102\frac{1}{2}$  tons, or 8 cwt. per foot of single line. With an additional distributed load of 3000 lbs. per lineal foot on each line, the tensile strain at the middle tension rods would be 4.27 tons per square inch in the middle truss, and 3.12 tons per square inch in the outer trusses; but, with a train on a single line only, the ordinary working

strains did not exceed  $2\frac{1}{2}$  tons per square inch in tension, nor 3 tons in compression.

In 1861, an iron bridge was erected on the line of the Pennsylvania Central Railroad, across the Schuylkill at Philadelphia. It had two clear spans of 192 feet each, and one pivot span, or turning bridge, 192 feet long. The construction was similar to that just described, but the truss was only 19 feet deep. The upright posts, or struts, were of wrought iron, so rolled that, when two bars were put together, they formed an octagonal tube. The top and bottom chords of the turning bridge were of wrought-iron rolled beams, so that either might resist extension or compression. The three spans, for a single line, contained an average of 5 cwt. of wrought iron, and  $7\frac{1}{2}$  cwt. of cast iron per lineal foot. The nett cost of the bridge, exclusive of masonry, was £8144. 10s. or £14. 4s. per lineal foot; the wrought iron costing £22. 15s. 6d., and the cast iron £6. 11s. 3d. per ton.

The pivot was of a kind extensively employed for turn-tables. It consisted of a fixed and of a moveable cast-iron disc, both grooved to receive a number of steel rollers, each turned to the frustra of a double cone. A circular railway was laid around the pivot, but the wheels only bore upon it, when the bridge was not truly balanced on the rollers. With a load of 14 tons balanced upon one of these bearings, the whole was revolved by a weight of  $3\frac{1}{2}$  lbs. hung over a pulley, and connected by a cord to the periphery of the turn-table.

The form of truss introduced by Mr. Wendel Bollman was next noticed. In it, the load upon each panel was transferred directly to the ends of the truss, through a pair of straight suspension bars, doing duty only in that panel. With the exception of one pair of suspension bars, supporting the centre of the bridge, the bars in each pair were of unequal length, and their lower ends were attached to the upper extremity of a compensating link, in order to allow for contraction and expansion. This bridge could not alter its form under unequal loading. A bridge upon this plan at Harper's Ferry, on the Baltimore and Ohio Railroad, had four parallel trusses for a double line, and a clear span of 124 feet. The span was divided into eight panels, and the depth of the truss was 17 feet 6 inches. The top chords were each formed of a single line of octagonal cast-iron pipes, and the vertical posts were also of cast iron. The strains upon the various parts of the truss caused by the weight of the bridge and of a load of  $1\frac{1}{2}$  ton per lineal foot, were 2.8 tons per square inch in compression in the top chord, and varied from 4.46 tons per square inch in tension in the longer suspension bars to 7.14 tons in the shorter bars. Mr. Bollman had stated that this bridge was tested with a moving weight of 122 tons of locomotives on one span of single line, or nearly 1 ton per lineal foot, and that the deflection, at a speed of 8 miles an hour, was  $1\frac{1}{2}$  inch at the centre.

The iron bridge designed by Mr. Albert Fink had been more extensively adopted than any other on the railways of the United States. In this bridge, a pair of diagonal tension bars connected the foot of the principal strut or king-post in each truss, with the ends of the top chord. This pair of diagonal bars supported one-half of the whole weight of the truss and its load. Each half span was subdivided by a strut, and two diagonal tension bars extended—one to the

nearest end of the top chord, and the other to the top of the centre post. Each quarter span was again subdivided into eights, and these again, for spans greater than 100 feet, into sixteenths. Under the direction of Mr. B. H. Latrobe, then engineer of the Baltimore and Ohio Railroad, in 1852, Mr. Fink erected an iron bridge of three spans, each of 205 feet, where that line crossed the Monongahela river. The depth of the truss was about one-ninth of the span, and the railway was carried at a little above the level of the bottom of the truss. The weight of the bridge, including the permanent way, was only half a ton per foot of single line, and with an additional load of 1 ton per lineal foot, the tensile strains upon the wrought iron did not exceed 5.15 tons per square inch, and the compression on the cast iron 4.25 tons. The Green River and the Barren River bridges were then alluded to, as being nearly identical in construction to that last described.

The Bollman and the Fink trusses for a single line, and in spans of from 160 feet to 200 feet, cost £14 per lineal foot, or nearly £28 per ton; while timber bridges of the same span only cost from £5 to £7 per foot. Still, iron bridges now met with an amount of favour which appeared certain to insure their ultimate substitution for timber bridges. A gradual preference was being shown to the plate girder, as the great annual range of temperature, from 20° below zero to a reflected heat of 130° in the summer sun, was not favourable to the use of cast iron in structures of such importance as railway bridges.

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May 9th, 1863.

The paper read was, "*On the manufacture of duplicate machines and engines*," by Mr. JOHN FERNIE, Assoc. Inst. C.E.

AFTER referring to the block-making machinery designed by the elder Brunel for Portsmouth Dockyard, and to the Small Arms Factory, at Enfield, as examples tending to show that the system of duplicates both cheapened and improved the manufacture of all articles to which it could be applied, the author remarked that, until lately, little or nothing had been done in its application to the manufacturing of machines or engines on a large scale. It was true the principle had been acknowledged, and various writers had urged the desirableness of its introduction into the railway system: but with such large component parts, special machines were out of the question, and the only other possible mode was working to a correct standard.

Mr. Whitworth, M. Inst. C.E., had advocated, in several papers read before different scientific societies, the adoption of a system of measurement for mechanical engineering work, in which the inch was to be the basis, subdivided into a thousand parts for the finer dimensions. In 1851, he exhibited a machine for obtaining fine, accurate measurements by touch, and he showed, by models, that the thousandth of an inch was not only an appreciable quantity, but, in many cases, its difference was what constituted a bad fit.

The author having long been satisfied that the mode of taking measurements in the workshop was behind the times, had, with the sanc-

tion of Mr. Kirtley, the locomotive superintendent, established, during the last five years, in the workshops of the Midland Railway, at Derby, a system which had proved most beneficial, not only in reducing the cost of the work, but in greatly improving it; and at the same time perfecting the only plan by which all the parts of engines could become duplicates of one another. The system of end measurement and a gravity piece, as invented by Mr. Whitworth, was adopted, and a machine was constructed capable of taking in 100 inches. This machine consisted of a strong bed plate, having, on the upper surface, a V groove, planed throughout its whole length. At one end there was a head stock, through which a square spindle, fitting the groove, was propelled by a hand wheel, which formed the nut of a screw having ten threads to an inch. This nut was in two parts, and could be tightened up by screws, so as to prevent lateral play; and a collar and washer, also adjustable, prevented any play in the head stock. The other end of the bed had also a head stock and screw movement, so as to adjust the length of the pieces in the groove, and bring the readings of the index to 0. The difference between this machine and Mr. Whitworth's was in the way the subdivisions of the inch were obtained. In the Whitworth machine, a screw, with exactly ten threads to an inch, was first made; whereas, in this machine, as a screw could not be found with exactly ten threads, it was necessary to run a thread on the face of the hand wheel, and subdivide this for the length required for an inch. The manner of obtaining duplicates with this machine was exceedingly simple. First, a perfect inch was got, and then a second was made, by means of the gravity piece; after which, all other sizes, up to 100 inches, were readily obtained. These sizes were now kept as duplicates. The finer dimensions were read from the divisions on the wheel, and from these, gauges, for use in the workshop, were made. All dimensions were thus duplicate multiples, or divisions of an inch, and a bare one-sixteenth of an inch became not an unknown quantity, variable with the rule or eye of the workman, but so many thousandths of an inch, which were stamped on the gauges, and were soon understood. One of the first applications of the system in the workshop, was to establish the necessary degree of tension required to ensure a perfect fit of a wheel on its axle. The result of experiments showed that, with a difference of  $\cdot005$  of an inch in the dimensions, there was a small permanent set in the wheel boss; but with a difference of  $\cdot008$  of an inch, the set was hardly perceptible. It was found, however, that, with ordinary lathe work,  $\cdot003$  was rather too fine a dimension, as lathes were seldom exactly true in their spindles. The size,  $\cdot005$ , was then finally adopted. In shrinking on outside cranks, it was found that  $\cdot015$  was sufficient to retain them in their places, while cross-head spindles,  $2\frac{1}{2}$  inches diameter, required a difference of  $\cdot004$ , and levers with 8-inch holes of only  $\cdot001$ .

The gauges were then described, as well as the manner in which the lengths of the eccentric rods were preserved uniform, and how the key groove in the outside cranks, and the eccentric key grooves, were cut. No setting out was required, and there was no chance of mistake from the carelessness of workmen. Unless the cranks and eccentrics were exact, they would not fit the tools, and thus a certainty was attained in the depth and position of the key groove.



Considerable improvements had been effected, of late years, in plate moulding, and the plan adopted at the Midland Railway Works, at Derby, was believed to be the first application of the system to such large and complicated castings as locomotive cylinders. Moulding boxes, for axle brasses, were exhibited, and a description was given of the manner of moulding cylinders. By this mode, a minimum quantity of sand was used. The projecting pieces, cast on the boxes, did away with the necessity of lifters; the castings came cleaner from the sand; the patterns were not knocked to pieces by rapping; and the cylinders were perfectly true in the bore and passages.

The plan of fitting together the various pieces, so as to ensure uniformity in erection as well as in detail, was then described; and it was urged that, by this system of accurate measurement, however large the parts might be, they became duplicates of one another, and could at any time be replaced. The advantages claimed were—economy in manufacture, greater excellence in workmanship, and a perfect system of duplicates, whereby the parts became interchangeable. The author especially recommended this system to the engineers of Indian and Colonial Railways, as there was no reason why the different parts of engines, and of rolling stock generally, should not be as perfect duplicates as those of the Enfield rifle.

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May 12, 1863.

The paper read was, "*On the communication between London and Dublin*," by Mr. W. WATSON, M.A., Assoc. Inst. C.E.

HOLYHEAD, the nearest point of land in Great Britain to the metropolis of Ireland, was naturally thought of at an early date as a convenient port of departure and arrival for the mails. This route had accordingly been used for a century and a half, and was recognised in an Act of Parliament passed in 1729; but the communication between London and Dublin was then irregular, and the time occupied on the journey protracted. Travelling through North Wales was attended with difficulty and fatigue, and the passage of the Channel was contingent on the state of the weather. Though measures of improvement were proposed before the close of the last century, no effectual steps were adopted, until after the legislative union had taken place between Great Britain and Ireland, in the year 1801. Then Public Commissions were constantly engaged in inquiries, and Committees of the House of Commons presented no less than twenty-five reports on the subject within ten years. These investigations had reference principally to the land part of the journey; and by means of large grants of public money, amounting, it was believed, to nearly one million sterling, in 1826 a continuous and easy road was completed between London and Holyhead, so that the entire distance of 267 miles could be performed, with regularity, safety, and comparative comfort, in thirty-four hours. Improvements for the sea part of the journey also engaged some degree of attention; but while sailing vessels were in use, it was not thought much could be gained in the passage of the Channel. In 1819, a steam vessel was placed on the Holyhead station for the summer and

autumn, and soon afterwards the "Royal Sovereign" and the "Meteor" were especially built for the Post Office service, with engines by Messrs. Boulton and Watt, and then the sailing cutters disappeared. The average length of the passages of these two steam vessels, in the first year, between Holyhead and Howth, was 7 hours and 33 minutes; the shortest passage was made in 5 hours and 48 minutes, and the longest was stated to have occupied upwards of 28 hours.

The mail communication between London and Dublin had been thus long maintained exclusively by way of Holyhead; but the rapidly-growing importance of Liverpool led to the establishment, in 1826, of a direct postal service between that port and Ireland. Steam vessels had been placed on that station, by private enterprise, as early as 1819, for the conveyance of passengers during the summer months; and in 1823, Mr. C. Wye Williams (Assoc. Inst. C.E.) originated a Company for the maintenance of a regular steam communication throughout the entire year, for the conveyance of passengers and of merchandise. As the railway from London to Liverpool was opened in 1838, that line became for some years the most expeditious route to Dublin, and the mails and passengers nearly deserted Holyhead. Liverpool did not long, however, retain this superiority; for, in 1849, a continuous line of railway was completed between London and Holyhead, by private capital, twenty-three years after the continuous line of road had been constructed, by direction of the State, and principally by grants of public money. The conveyance of the Irish mails was then re-transferred from Liverpool to Holyhead, and the large and powerful packets of the Government and of the Company, which had carried the night mail under contract for the previous ten years on the Liverpool line, were appropriated to other duties.

During the time these changes were in progress, the packet service was transferred from Howth to the Asylum Harbour at Kingstown, which was ultimately connected with Dublin by a railway six miles in length. The only link then remaining to complete the communication with Ireland was a superior class of vessels. The Government having decided on building four vessels, each of 700 tons burthen, with engines of 350 H.P., the best result was admitted to have been attained; as the rate of speed of the "Banshee" at the measured mile, was upwards of 18 statute miles an hour, or nearly 4 miles in excess of any previously obtained. After a short trial of this service at heavy cost, the Lords of the Admiralty determined that it should be performed by contract, as had previously been the case on the Liverpool line, and that the average speed should be 12 knots, or nearly 14 statute miles, per hour. This service lasted from May, 1850, until October, 1860, and was performed within the stipulated time.

Further improvements being still demanded, a plan was submitted to Government, and a new postal contract was entered into, the main provisions of which were, first, that the entire distance between London and Kingstown, instead of to Dublin, was to be performed in eleven hours, allowing four hours for the sea passage; secondly, that four steam packets should be specially built for the service; thirdly, that express trains should be appropriated exclusively to the Irish traffic; and fourthly, a morning and evening departure from each capital. The vessels referred to were each 2000 tons burthen, and in their dimen-

sions and general arrangements were nearly identical. Three—the “Connaught,” the “Ulster,” and the “Munster,”—were built by Messrs. Laird, and one—the “Leinster,”—by Mr. Samuda. The ships were of iron, timber having been used only for the decks and cabin fittings. The length of the “Connaught” between the perpendiculars was 334 feet, the beam was 35 feet, and the depth 21 feet. There were nine principal water-tight bulkheads, which not only provided for the safety of the ship in case of accident, but added greatly to the strength. The bulwarks were of iron plates, in continuation of the sides of the vessels, without any break for gangways. Between the paddle-boxes there was an upper deck, which further added to the strength amidships; and on this was placed the wheel and binnacle. The entire of the main deck, from the foremost funnel forward, was covered by a hurricane deck, which had been found of great advantage in throwing off seas in heavy weather. The engines in all the vessels were on the oscillating principle. Those for the “Connaught” and the “Leinster” were made by Messrs. Ravenhill, Salkeld, & Co. The cylinders were 98 inches diameter and 6 feet 6 inches stroke; the air pump being 54 inches diameter, with a length of stroke of 2 feet 6 inches. The boilers were multitubular, eight in number, four at each end of the engine room space, arranged in pairs, with one funnel to each pair. There were five fire grates in each boiler, and the total grate surface was 677 square feet, the heating surface exceeding 19,000 feet. The wheels were 31 feet in diameter to the outside of the floats, which were feathering, fourteen in number, and each was 12 feet long by 4 feet 4 inches broad. On the trial trips, the engines worked at the rate of  $25\frac{1}{2}$  revolutions per minute, with 25 lbs. steam. The mean of the runs of the “Leinster” at the measured mile was  $20\frac{1}{2}$ , and of the “Connaught”  $20\frac{1}{4}$  statute miles per hour. The engines of the “Ulster” and the “Munster” were constructed by Messrs. James Watt & Co. The cylinders were 96 inches in diameter, with a length of stroke of 7 feet. The wheels were 33 feet in diameter. The boilers had each six fire places, giving an equal extent of grate surface with the other. The heating surface measured 18,033 square feet. These engines were erected on board the vessels in the Liverpool Docks; and from a return of observations made on several trips—there being no measured mile at that port for testing speed—the rate attained appeared to have been  $20\frac{1}{2}$  statute miles per hour. One of the principal peculiarities, which made these vessels of so unique a class, was the post-office, fitted for sorting letters on the passage, so that the letters were ready for delivery, or to be forwarded to their destination, on the arrival of the vessels, either at Kingstown or at Holyhead. About two hours were thus saved in the transmission of the mail.

The contract with the Postmaster-General had appointed January, 1861, for the commencement of the improved service. But as the vessels were in readiness some months sooner, it was commenced in October, 1860, and had since been continued without interruption. From what had been already stated, it would have been seen, that the difference of speed between the four vessels on the trial trips was inappreciable—a matter of paramount importance to a mail service. Thus, while the shortest passage of the “Connaught” across the Channel occupied three hours and fourteen minutes—being at the rate

of about 20 miles an hour—the shortest passages of the “Leinster,” the “Ulster,” and the “Munster,” were three hours and twenty minutes, three hours and eighteen minutes, and three hours and twenty-two minutes respectively. Their average performance for the two years and five months during which they had been on service, inclusive of the trips made in fogs, gales, &c., was still closer, as

|                 |                       | Hrs. Mins. |       |                 |   |
|-----------------|-----------------------|------------|-------|-----------------|---|
| The “Connaught” | made 1064 passages in | 3          | 51½   | on the average. |   |
| ” “Leinster”    | ” 919                 | ”          | 3 52½ | ”               | ” |
| ” “Ulster”      | ” 925                 | ”          | 3 55  | ”               | ” |
| ” “Munster”     | ” 920                 | ”          | 3 58½ | ”               | ” |

The consumption of coal in the first few months was considerably in excess of the quantity originally estimated. Steam of from 25 lbs. to 28 lbs. pressure was then used; but satisfactory arrangements had since been made to reduce the consumption, while the additional time occupied on the passage was but a few minutes, and was still within the time allotted to the sea service. The engines in the “Ulster” and the “Munster” had been provided with super-heaters, but experience had not shown any advantage, either as reducing the consumption of coal, or as tending to a superior performance. These vessels had made in the aggregate 1845 passages, in the average time of 3 hours 56½ minutes, and had consumed 30 tons 7 cwt. of coal as the average of each, inclusive of the quantity required for raising steam, which was considerable. The “Leinster” and the “Connaught,” without super-heaters, had made 1983 passages in the average time of 3 hours 52 minutes, and had consumed, inclusive of raising steam, on the average, 30 tons 1 cwt. of coal.

It was satisfactory to be able to state, that the ships had, so far, needed no repairs, being now in as perfect a condition as when the service was commenced in 1860. The frequency of docking, for the purpose of cleaning and coating, had afforded constant opportunities of examination, when painting only had been required.

In conclusion, the author referred to the admirable performance of the land portion of the journey, from London to Holyhead, by the London and North Western Railway Company; the punctuality in the arrival of the trains on the jetty at the latter place, the speed maintained, and the excellence of the carriages, were the subject of universal approval. Further improvements, at present not thought of, might yet be brought into operation; but there appeared to be no reason for apprehending that the communication by way of Holyhead would ever cease to be the best for postal purposes, and to be preferred by the travelling public, so long as the entire distance between London and Dublin could be accomplished within eleven hours and a half.

## INSTITUTION OF MECHANICAL ENGINEERS.

*"On the manufacture of hemp and wire rope,"* by Mr. CHARLES P. B. SHELLEY.

(Continued from page 303, Vol. XVII.)

**WIRE ROPE.**—The second branch of the subject of the present paper is, the manufacture of iron wire rope, which although at first made by hand, is now made exclusively by machinery; and the writer is indebted to Mr. Archibald Smith for kindly furnishing the information on this branch of the subject.

Wire ropes were used as early as thirty-nine years ago for the supporting cables of a suspension bridge at Geneva; and also for the Freiburg suspension bridge of 807 feet clear span, erected twenty-seven years ago. The wire ropes, in the latter case, are constructed of 20 bundles or strands of straight iron wire, 0.125 inch diameter, stretched parallel, forming a rope of  $5\frac{1}{2}$  inches diameter, and bound round with wire at 2 feet intervals.

The first form of wire rope regularly manufactured, was made about twenty-seven years ago, and was known as "Selvagee." It consisted of a number of hard or unannealed wires, of about 12 to 16 wire-gauge, or 0.110 to 0.065 inch diameter, which were stretched parallel and bound together by a fine wire of about 20 wire-gauge, or 0.036 inch diameter, wound spirally around; after which a "parcelling" of woollen list was also wound round in the contrary direction, with the edges lapped so as to cover the wires entirely: the rope was completed by a service of tarred yarn wound on in the contrary direction to the list. The method of making the rope was, simply to warp or stretch the wires at a uniform tension over two hooks set at the distance of the length of rope required to be made, passing the wires backwards and forwards over the hooks as many times as was necessary to make up the size required. A solution of india-rubber, boiled down in linseed oil with a mixture of resin and tar, was rubbed carefully into the body of the rope, previous to binding up; and after the binding wire had been wound on, the solution was again applied to the exterior wires, to prevent oxidation, the process of galvanising being unknown or not practised at that time. The "parcelling" of list was also saturated with the solution, the yarn being tarred as usual. The binding and parcelling were always done by hand, before the rope was taken off the hooks; but the service of yarn was usually laid on by a machine for that purpose, though occasionally also by hand. The method of attaching the fittings, such as shackles, thimbles, and dead eyes, was either by forming an eye during the process of warping to receive them, or by inserting the end of the rope, stripped to the wires, into a conical socket attached to the shackle, and turning back the ends of the wires, so as to prevent the rope being drawn out. But more generally the fittings were "turned in," that is, the end of the rope was doubled round and "seized" or bound to the standing part. It will be seen that it was very difficult to splice this form of rope, owing to the absence of twist or "lay."

Ropes thus made were exceedingly rigid and non-elastic, but possessed greater strength than any other construction; in fact, the entire

strength of the wire was preserved. The "parcelling" and "service" added to the size, but not at all to the strength, being intended only for protecting the wires. The want of elasticity and pliability, together with the difficulty of fitting, and the constant wear of the "service" of yarn, acted somewhat prejudicially against the introduction of this first form of wire rope on an extensive scale; yet it was used in the royal navy and mercantile marine, and also for suspension and tension bridges: for the latter purpose it is still used, especially in California, where a large number of wire rope suspension bridges are now being erected to replace those destroyed by recent floods.

The machinery for making these "selvagee" ropes consisted simply of the two hooks over which the wire was warped, which were attached to moveable posts set at the required distance asunder. The "serving" machine was a long wooden trough, extending nearly the entire length of the rope ground, having a revolving shaft at each end, with a hook at its extremity, and carrying a fast and loose pulley, over which a driving band passed. The two serving hooks were driven at the same speed of about 400 revolutions per minute: and the shifting forks of the driving bands were connected by a cord extending throughout the length of the ground, so that the workman could stop or start the machine at any part. An ordinary serving mallet was employed for laying on the yarn, and was guided by the workman who also regulated the tension, the yarn being supplied from reels hung over-head.

The next description of wire rope, known as "formed" rope, was introduced about twenty-five years ago. It consisted of a number of soft or annealed wires, usually about 14 wire-gauge or 0.085 inch diameter, "formed" or twisted into a strand, but with little or no regard to regularity; and four of these strands were "laid" into a rope, though this number was not always the same. The number of wires was varied according to the size of rope required, and occasionally the size of wire was altered to suit circumstances. These ropes closely resembled ordinary hemp ropes in appearance. The twist caused by "forming" the strands remained in the wire as a permanent set, and the strands were "laid" together with an extra amount of twist or "forehard" in each strand, which was necessary to keep the rope together. Little or no injury was done to the wire by this process, owing to its being annealed, and also from the length of the twist of the wires in each strand, which was usually about 12 inches pitch; but it would be almost impossible to use hard wire in this manner.

The "formed" wire ropes possessed great pliability and some amount of elasticity; they were readily spliced and fitted, like ordinary ropes, and though not so strong as the "selvagee" wire ropes, they possessed many advantages and were more easily introduced. Their adoption for rigging, incline, and traction ropes, became extensive; and this construction was the first wire rope used on the Blackwall Railway. The small size and soft nature of the wire used offered little resistance to exterior friction, and when employed as incline or running ropes, they soon flattened and wore out. The irregularity with which the wires were "formed" or twisted into strands, frequently crossing and re-crossing one another, and the great difference in the length of the wires, as well as the short "lay" of the ropes, amounting to only 4½ inches pitch, materially assisted to destroy them. Even when used

simply as standing rigging, the wires frequently broke, and the broken ends stuck outwards, to the danger of the sailors handling the rigging; and, to prevent accidents, they were served with yarn, like the "selvages" rope, after having been "wormed," that is, having a yarn laid in between each strand, so as to alter the shape to a round form.

The "formed" wire ropes were originally made on the rope-ground by the forming machine usually employed in hemp rope making. The wires were wound on bobbins placed in racks, just like the hemp yarns, and were led through the perforated register plate, called the "minor" plate, thence through the taper steel nipper or compressing tube, and were attached to the forming machine, which drew out the wires and twisted them together as it travelled backwards towards the other end of the ground. Having arrived there, the machine was stopped, and the length of strand thus made was wound upon a large reel, ready to be placed in the laying machine; the use of the reel also enabled a longer length of strand to be made than one length of the ground. For laying the strands into rope, the required number of reels of strand (generally four) were placed in the frames, mounted on horizontal bearings, and geared together. The strands were stretched along the rope-ground, being supported and separated on trestles placed at intervals; and were brought together over a "laying top," at the other end of the ground, and attached to a revolving hook. Motion was given to the machine, at one end, with the four strand reels, and to the hook, at the other end, in the opposite direction, by means of a "fly rope," or endless driving rope, passing over whelp wheels, attached to the machine and the hook: the laying top was carried by a workman, who thus regulated the amount of lay or twist. Afterwards the laying top was mounted on a carriage, which travelled on rails, and was drawn forwards by another endless rope, called the "ground" rope, which was worked by the machine. This arrangement had the effect of more effectually regulating the lay. "Formed" wire rope is now made in the ordinary vertical machine, which is supplied with extra frames for carrying a large number of bobbins; but for forming the strands, the bobbin frames are fixed to the frame of the machine, and not revolving in it; and the wires are brought together through a perforated plate containing the required number of holes.

"Formed" wire ropes were at first well saturated with the solution before described; but afterwards, galvanised wire was used for making them. The Admiralty still continue to use the "formed" rope entirely, though little is now used elsewhere. "Formed" ropes, made of copper wire, were used largely in the navy as lightning conductors, the size of the wire being about No. 20 wire-gauge, or 0.036 inch diameter; and the rope was made of four strands, laid round a small copper wire core. Smaller ropes, composed of iron and copper wire, were also used as sash lines, &c.

In another kind of wire rope, which was sometimes made on the machinery above described for the manufacture of "formed" rope, the strands were composed of hard wires, usually not exceeding six in number, laid around a core of hemp or wire; and these strands were again laid around a hemp core into a rope. But the objections caused by the rigidity of these ropes, prevented any but small sizes being used for some years. Ultimately, however, these objections were overcome,

and this construction has now almost entirely superseded the "formed" rope.

The first flat wire ropes, made 26 years ago, were composed of from eight to twelve "formed" strands, with the twist alternately right and left-handed, made of a number of fine wires, usually about 18 or 20 wire-gauge, or 0.050 to 0.036 inch diameter. These strands were placed in the position of the warp, in a loom of the ordinary form, but of greater strength, and were woven together with a shoot of strong yarn. Very little twist was put into the strands, as the yarn, when woven in, kept them in form. These ropes were by no means durable, as the yarn soon wore out, especially at the edges; and their application was very limited.

Flat wire ropes were next made, about twenty-five years ago, of four or six "formed" ropes, each made of four strands "laid" very long, and alternately right and left-handed; these were stretched together side by side, and sewn through with six wires of No. 14 or 16 wire-gauge from side to side, in a zig-zag direction. This was accomplished by carefully inserting a needle of dagger shape between the strands of the ropes, and so making a passage for the wires, which were carefully laid side by side. The round ropes, thus bound together, resembled the ordinary flat hemp rope in appearance. The process was tedious, on account of the care necessary to avoid penetrating the strands with the needle, which would do great injury to the rope. It was also important that the amount of "lay" or twist in all the ropes composing the flat rope should be exactly the same, otherwise the stretching could not be regular, and some of the strands were liable to be cut when the rope was set to work. With the machinery previously described perfect regularity could not be attained in this respect, and an unsatisfactory result was the consequence.

The next and last construction of wire rope, introduced about twenty-four years ago, is known as "laid" rope, in which the strands were made of a few wires, seldom exceeding six, "laid" around a core of hemp or wire, the wires of the strand being entirely free from twist; each wire being simply "laid" in a spiral form without any twist in the wire itself. Six of these strands were again "laid," without "forehard" or additional twist, into a rope, around a core, generally of hemp. The size of wire usually varied with the size of the rope, as the total number of wires (thirty-six) was seldom varied. The wire was hard or unannealed, and by the system adopted in making, a uniform length was obtained, with entire absence of twist. By this means the full strength of the wire was retained, and consequently the rope produced was much stronger for the same weight. An increase in size is, however, caused by the introduction of the hemp cores, which amount to one-seventh of the entire bulk in the case of ropes with six strands of six wires each, the construction now usually adopted.

These "laid" wire ropes, though not so pliable or strong as "formed" ropes, possess many advantages, especially when employed as incline ropes, the hardness and increased size of the wire giving greatly increased durability; and as the prejudice against wire ropes had been partially removed by the introduction of the "formed" ropes, the present "laid" ropes soon began to be extensively used; and within the last few years, since the expiration of many patents formerly



existing, the manufacture has increased to a remarkable extent. Wire strand has lately come into extensive use for fencing, very large quantities being exported for that purpose for the Indian railways.

Flat wire ropes also are now made with strands composed of hard wires "laid" together, instead of "formed" as previously, these strands being again "laid" into ropes without any "forehard" or additional twist, and the ropes are then stitched together as previously described. Lately, instead of several wires laid side by side being used for stitching, three or four strands have been substituted, each strand containing three wires laid together; the advantage of which is, that though several of the single wires may be worn through, the strand still holds the rope together; yet in neatness of appearance the single wires have the preference.

The machinery used in the manufacture of "laid" strands and ropes originally consisted of the ordinary machinery used on rope grounds for laying or closing hemp ropes, the machines at each end of the factory being speeded alike, as previously described.

The next form of machine adopted had simply one hook, mounted in bearings on a fixed frame, and driven by hand or power, to which all the wires composing the strands were attached; these were stretched along the ground, supported at intervals on trestles, till they reached the other end, where they were hooked on to swivels or "lopers." Attached to the lopers were cords, passing over pulleys and having weights suspended from them, so as to regulate the tension of each wire, and also allow for the shrinkage of the rope in the process of making. When the hook was set in motion, the twist in each wire traversed the entire length of the wire, and escaped at the end by means of the "loper" or swivel. A perforated plate or "laying top" was used, carried by a workman along the ground, regulating the amount of "lay" or twist.

The next machine used was a modification of Huddart's hemp rope laying machine, previously described. In these machines the operation went on continuously until the required length of strand or rope was made, giving rise to the name of "endless" machines; they were also called "vertical" machines, because the main frame carrying the spools revolves on a vertical axis. The first modification of this machine for making wire ropes consisted in altering the gearing for working the spool frames, so that no additional twist or "forehard" was put in the wires as in the strands of hemp ropes, the pinions on the spool frames being now made of exactly the same diameter as the central dead wheel, causing the spool frames to make exactly one rotation on their axes for each revolution of the machine. Machines of this description were also made to work on a horizontal axis instead of a vertical one, and a balance weight was sometimes attached to each spool frame in the horizontal machines, which, by its gravity, prevented the spool from twisting the wire, and rendered gearing unnecessary for the purpose; but the speed of these machines was limited in consequence.

The next form of machine was that known as a "compound" machine, for producing the entire rope finished at one operation, and may be described as consisting of six stranding machines, like that last described, all mounted on one large frame and revolving horizontally; the necessary motion being given to the machinery to lay the wires

into strands, and then the strands into rope, without producing any twist in the individual wires. This machine, though a mechanical success, was a commercial failure, and was soon abandoned for the simpler and cheaper plan of first making the strands, and then laying them into ropes on separate machines.

Next, some modification was made in the vertical machines, to prevent twist of the wires during the laying, by employing a centre crank or excentric and four outer cranks on the spool frames, and also by substituting chain wheels and pitch chain for spur gearing. Machines were constructed with thirty-six spools on the revolving frame, connected by cranks to the centre crank, and ropes were thus made with that or any smaller number of untwisted wires in each strand; but this description of rope was rarely used.

In all the vertical and horizontal endless machines that have now been described, all the spools were mounted in one set on a single large revolving table, thus revolving all in one plane; and during the process of laying, the whole weight of the material had to be carried round a circular track, varying with the size of the machine, from 10 to 40 feet; one revolution being necessary for every lay put into the strand or rope, the lay varying from 1 inch to 18 inches or more in pitch, according to the size of rope. Machines of this construction were therefore necessarily limited in their speed. Lately, however, machines have been constructed with the spools arranged in two sets of three each, on two tables, one below or behind the other, the spools thus revolving in two planes, whereby a somewhat increased speed was attained as the diameter of the revolving tables was reduced; yet still the spool frames had to be carried round the common centre, and caused to rotate on their own centres once for every lay.

The method of joining the lengths of wires was in the first instance by twisting the ends together; afterwards, in the manufacture of "laid" strands, by "tucking," that is, cutting out the hemp core about 12 inches from the end of the wire that has run out, and inserting in its place the end of the new length of wire; the rest of the wires are then "laid" up on the new wire as a core for a length of 6 inches, when the new wire is brought out into its right place, and the remaining 6 inches of the old wire passed in as the core, on which the laying is again continued till the end of the wire is reached; the proper hemp core is then replaced, and the process of laying resumed as before. Some manufacturers prefer to braze or weld the ends of the wires together for joining the lengths; wire as small as No. 16 wire-gauge, or 0.065 inch diameter, being welded by experienced workmen, by means of a common portable forge.

An improved construction of wire rope machine has subsequently been introduced, in which the bobbin frames and bobbins are placed one behind another, all in the axis of the revolving frame, and remain stationary in that position while the frame alone is made to revolve. By this machine a greatly-increased speed is attained, and it is considered that better work is produced. The rate of production is also increased; as much as 10,000 yards of strand having been made per day of ten hours, instead of only 2500 yards, the usual amount made by the ordinary form of machine.

In this machine (the invention of Mr. Archibald Smith, of London),

wherein the bobbins are all arranged in a horizontal line, one behind another, the revolving frame is composed of a number of disc wheels, framed together by three long bolts passing through holes near the edges of the discs, and through strong iron distance tubes with collars at each end, which are all turned accurately to one length. Eight discs are thus framed together by the three bolts, and separated by the distance tubes, forming seven compartments of the machine, each containing a bobbin of wire. The last disc at the back end of the machine forms part of a three-speed cone pulley, by which the entire frame is made to revolve; being supported and steadied sideways at every alternate disc by three rollers mounted in fixed bearings. The bobbin frames are centred in the revolving discs, and have a weight suspended from their under side sufficient to overcome the friction of the bearings, and prevent the bobbin frames from revolving with the machine.

The front end of each bobbin frame has a hollow steel stud or "nipple," carefully bell-mouthed, and the back end has a solid stud. Each stud works in a boss cast on the disc, having a clear hole right through the centre for the wire to pass through; and the boss on the front side of the disc has a large gap for the wire to pass out from the centre. The wire from each bobbin is drawn off through the bell-mouthed stud and the centre of the disc, and is then taken round a leading pulley fixed on a framing bolt, for the purpose of enabling the wire to clear the bobbin in the next compartment. The wires pass through holes in the discs on either side of the framing bolts, and on reaching the front compartment of the machine, all the six wires from the six bobbins are led round three pairs of leading pulleys, and thence through the holes in the front disc through the laying plate and over the laying top. The laying plate is attached to the front disc of the machine, and has a slot in it, for each wire to pass through. The laying top, fixed in front of the laying plate, is simply a cast iron block with the required number of scores or grooves for the wires. The front bobbin, in the first compartment of the machine, carries a seventh wire, to form the core for the six external wires, which is led off through the centre of the front disc and through a hole in the centre of the laying plate and laying top. The tension or "temper" of each of the seven wires is regulated to the exact amount required by a friction break on the spindle of each bobbin. The bearings of the spindle in the bobbin frame are provided with spring caps, to facilitate changing the bobbins.

The six wires are all brought together at a point immediately in front of the laying top, where they are all laid round the core by the revolution of the machine; the bobbins remaining stationary, with the exception of their unwinding motion as the wires are drawn off: each wire is thus laid into the strand free from twist in itself. The strand thus made passes between nipping rollers, having a series of scores of different diameters to suit various sizes of strand or rope: the lower roller turns on a fixed stud, and the upper one on a weighted lever. The strand is then led half round an indicator sheave, which has a counter attached, to indicate the number of yards or fathoms made. Thence it passes backwards alongside the machine to draw-off wheels at the back end; these are V-grooved wheels of equal diameter, round which the strand passes in a figure of 8 course, being pressed

tight into the groove of the second wheel by a tightening roller or jockey wheel, which prevents the strand from slipping from any accidental cause. The draw-off wheels are driven from the driving pulley by intermediate bevil gearing with a change wheel, by which the speed of the draw-off wheels is regulated in proportion to the speed of revolution of the machine, whereby the lay of the wires or pitch of the spiral in the strand is determined. The strand, finally leaving the machine from the draw-off wheels, is wound on a bobbin, ready to be placed in a second similar machine to be laid into rope. In this second machine, the revolution of the laying apparatus is in the opposite direction, while that of the draw-off wheels is in the same direction, as in the first machine; in order to make the lay of the strands in the rope contrary to that of the wires in each strand. From the second machine the rope is coiled on a reel; or, in case of its being a long length, it is sometimes coiled down direct into railway trucks, &c., for transportation.

In this machine, instead of the bobbins and bobbin frames, which sometimes contain half a ton weight each, being carried round the common centre of the machine, sometimes describing a circle of 15 feet diameter, and also rotating on the axes of the bobbin frames once for every lay in the rope, the same result is attained without any motion being given to the bobbin frames. This is an important advantage, because, in course of working, some of the bobbins are full while others are nearly empty, and in the case of the old machinery a great strain is thereby thrown on the parts of the machine from the variation in weight; while in the construction just described, the equilibrium of the machine is never disturbed. In addition to this, great regularity of lay results from the wire being free to unwind, and from the absence of the extra tension that was necessary to prevent the wire being disturbed when rapidly carried round in the old machine. The stationary position of the bobbins enables the workmen to see what is going on, and no entanglement of the wire takes place, as is frequently the case in other machines.

About 35,000 miles of the covering strands of the Atlantic telegraph cable were made in this machine, and likewise about 14,000 miles of the hemp-covered strands of the Toulon and Algiers cable. It is also extensively used in the manufacture of wire ropes.

Steel wires are now extensively used in the manufacture of wire ropes, being found to possess twice the strength of the best charcoal iron wire; while the skin of the wire is of such remarkable hardness as to resist a very great amount of friction, and the wire has a toughness equal to that of copper. A compound hemp rope is also now made by inserting a wire in the centre of each yarn, and making these yarns up as an ordinary hemp rope.

A number of specimens of hemp and wire ropes were exhibited, illustrating the several constructions described in the paper, and also working models of some of the rope-making machines, lent for the occasion from the South Kensington Museum. A working model was also exhibited, and shown in action, of Smith's wire rope machine, described in the paper.

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## LONDON ASSOCIATION OF FOREMEN ENGINEERS.

6th June, 1863.

MR. JOSEPH NEWTON, PRESIDENT, IN THE CHAIR.

THE adjourned discussion of a paper, read at the previous meeting by the President, on "*Marine Propulsion*," was re-opened by Mr. Walker, who said that he had been under the impression that the system of propulsion described by Mr. Newton at their last meeting was little more than a resuscitated scheme of the celebrated Symington. It was only fair now to state, that there was an error on his (Mr. Walker's) part. He had carefully compared the drawings of the chain propeller of Mr. Vaile with those of Symington, and found that in many material respects they differed. Every point of difference constituted an improvement, and Mr. Vaile's plans presented, consequently, great advantages over those of the old engineer to whom he had referred.

In Mr. Vaile's propeller it was proposed to attach the floats to the chains in a very simple manner, to give them feathering properties, and to submerge the whole apparatus. All these arrangements were new, and so far superior to any previous invention of the kind. Still he was of opinion that practical obstacles would be found to militate against its extended introduction: the number of working parts in the chains would subject them to derangement. Simplicity of construction was the thing to be aimed at in contrivances for propelling ships; in the screw they had this; and if, theoretically, that were less effective than the Vaile propeller, practically he thought it would be found more so. It must be admitted, nevertheless, that some strong claims had been advanced by the reader of the paper in favour of the new propeller. Such a claim was that, for example, in regard to the annihilation of the evils of "slip." There would be but little possibility of slip occurring if the continuously-acting floats of Mr. Vaile were used. Their liability to dislocation must not be lost sight of, however. In its general principles he agreed with the Vaile system of propulsion, and it was only on the ground of supposed imperfection in its mechanical details that he differed. A series of experiments might have the effect of removing his objections altogether.

Mr. Oubridge coincided to some extent with what they had just heard. He thought that, so far as general principles were concerned, Mr. Vaile had it all his own way: his plans were ingenious, and completely in accordance with natural laws. The practical test—the final arbiter in all such cases—could alone answer the question as to the ultimate success of the submerged and feathering-floated propeller. That test he should like to see applied, and he had hope that its results would be favorable to the inventor's views.

Mr. Ives saw what he conceived to be an insurmountable barrier to the general adoption of the new propellers. In order to obtain anything like an extraordinary speed in a ship fitted with them, the chains and floats must be made to travel at the rate of 1000 feet per minute. If this speed were to be obtained by the intervention of toothed gearing, the wear and tear and the shock, or succession of shocks, to chains and

gearing would quickly destroy both. As to the feathering powers of the continuous-propeller floats, he did not value them very highly; and it was, he believed, a fact that feathering paddle-wheels were dying out, at least in sea-going ships.

Mr. Ross considered that the speed of the propelling chains might very well be maintained at 1000 feet per minute, supposing that the joints and connecting pins were properly fitted up in the first instance. The resistance against the engines would, from the submergence of the apparatus, be always equal. Where, then, were the destructive "shocks" to come from? As to the abandonment of feathering paddle-wheels, that had little bearing upon the question of feathering propellers such as that of Mr. Vaile, supposing it were true; but he (Mr. Ross) was in a position to assert that, in the most recently launched steamer of the West India Mail Company, feathering paddles were employed. On the whole, he regarded Mr. Vaile's system of propulsion most favourably, and trusted that that gentleman would pursue it to practical realization.

Mr. Jones compared the action of the propelling chains to that of the lifting chains of dredging barges, and thence drew unfavourable inferences as to the practicability or value of the former. Of course, it was desirable to apply the propelling power of a ship very low down, if that could be advantageously and economically done. This was a problem difficult of solution.

Mr. Stabler, though approving of all the ideas of marine propulsion advanced in the paper of their President, saw, he confessed, some impediments to their practical establishment. Murray's chain pumps were constructed on a plan not dissimilar to that of the proposed chain propellers of Mr. Vaile, and they could not be worked very rapidly without much inconvenience. For ocean navigation he imagined the Vaile propeller was not altogether suitable, but on rivers and canals it might be found of great value. For tug-boat service, too, it was, he thought, well calculated. It was not possible to comprehend the existence of "slip" when every inch of float surface was constantly in action, as it would be in this case. Theoretically the advocates of the continuous-action propeller were right; it might prove that they were so practically. That time and experiment must determine.

Mr. Hayes had much confidence in the new system of propelling ships and boats as explained and advocated by the writer of the recent paper on the subject. The plan seemed to him to be fraught with all the elements of success. It only required the application of speculative energy, or mechanical skill, to enable it to take the field against screw or paddle-wheel, and, perhaps, to drive them both out of it.

Mr. Stanley feared that the chains might, from their rapid movement, and the constant strain upon their joints, get out of pitch, and thus create annoyance and difficulty. If elongation of the chains once commenced, it was difficult to say where it would end. Apart from this consideration, he liked the scheme much, and hoped to see it tried on a large scale.

Mr. Vaile, on the invitation of the Chairman, replied to the various objections *seriatim*. He considered that the exceptions taken to the scheme, which he had well digested, would be found, in practice, to be illusory. He did not wish, as a rule, that geared engines should be used

for getting up the speed of his propellers, but if they were, there was no reason to fear for the consequences. The pressure on the teeth of the wheels would be uniform, and there would be no such thing as "back lash," or shock of any kind, to destroy the gearing; and the float-arms, which worked in guides, for preserving the feathering movement of the floats, would be constantly and smoothly in action. His favorite notion, as regarded the motive power to be employed, was that of direct-acting engines, with small cylinders and rapid stroke. If they were on the horizontal principle, so much the better, and so much the less costly would they be.

The President observed, that most of the objections raised that evening to his friend Mr. Vaile's scheme, had, he thought, been anticipated in the paper he had had the honour of reading on that day month. He was glad to find that almost all his fellow members agreed with the general principles of the "Vaile propeller;" and he had confidence that the objections to details would melt away after the first trial trip of a Vaile-propelled steamer, if he might use, for shortness, that expression. Possibly the endless chain-propeller might eventually effect a marvellous change in steam navigation, which avowedly was yet in its infancy. At any rate he, after having studied Mr. Vaile's plans closely and scrutinizingly, was of opinion that they were deserving of every attention from those interested in marine propulsion.

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#### ERRATUM.

In Mr. Newton's paper, reported in last number, at line 14, page 360, for "feathering of boats" read "feathering-floats."

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### Scientific Adjudication.

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#### IN CHANCERY.

*Before Vice-Chancellor Sir W. P. Wood, and a Special Jury.*

NEEDHAM AND KITE *v.* OXLEY.

THIS was an action brought by Messrs. Needham and Kite, of the Phoenix Iron Works, Vauxhall, engineers, for the alleged infringement, by Mr. James Oxley, of Frome, Somersetshire, brewers' engineer, of a patent granted to them, for "improvements in machinery and apparatus for expressing liquid or moisture from substances," dated July 14th, 1853.

The counsel for the plaintiffs were Sir Hugh Cairns, Q.C., Mr. Hindmarch, Q.C. (of the common law bar), Mr. Bagshawe, and Mr. Needham (of the common law bar). For the defendant, Mr. Giffard, Q.C., Mr. Karslake, Q.C. (of the common law bar), Mr. Aston (of the common law bar), and Mr. Langworthy.

The specification of Messrs. Needham and Kite described a combination of parts, consisting of a number of slabs of wood, or other material, grooved on both surfaces, and bound together in a strong

frame by tie rods or otherwise, with filtering cloths between each pair of slabs, and with supporting laths or blocks at the sides, forming "chambers or cells," each of which is put in communication with a force pump, by means of a branch pipe connected with a stand pipe, common to all of the several branch pipes. There was also a stop-cock to each branch pipe, by which the communication of any particular chamber or cell with the force pump might be shut off if required.

The scientific witnesses for the plaintiffs spoke to the novelty of this combination forming a filter press; and a considerable amount of evidence as to the value of the machines for various purposes was produced by persons who had used them in their respective manufactures. It was contended, on behalf of the plaintiffs, that although the several parts forming the combination were to be found in previous patents, with the exception of closed chambers or cells, yet the plaintiffs were the first to put them all together, so as to make, in their combined form, a machine capable of being adapted to various uses requiring different degrees of regulated pressure.

It was also alleged that the defendant had applied to the plaintiffs for a license, thereby acknowledging the validity of their patent. This, however, was denied.

The defendant had constructed machines with a series of chambers combined together, but had pierced the slabs with holes, for the passage of the expressed liquid, and had placed coarse wire gauze over the holes, that is to say, between the filtering cloths and the perforated slabs; pieces of wood being fixed on to the slabs to cause a small space to intervene between the wire gauze and the perforated slab.

It was urged, on the part of the defendant, that parts of the combination (stand pipes, branch pipes, and tie rods), claimed by the plaintiffs, and said to be material, were not mentioned in their provisional specification; also that the final specification described old and new parts together, and did not sufficiently distinguish between them; also that there was no infringement, because the defendant had only taken the combinations of former patents, and added something to them, by which he had been enabled to produce a better machine than the plaintiffs'. The difference between the two machines was not merely colorable, but substantial, inasmuch as an increased filtering surface was thereby produced.

The scientific witnesses for the defendant said, that the specification of one Billiter, bearing date 27th May, 1843, included the combination claimed by the plaintiffs, except as to closed chambers, and combining them so as to support each other; also that the specification of one Durnerin, bearing date 21st March, 1853, contained closed chambers, but of a different form from plaintiffs', and that he claimed a modification of form, while plaintiffs likewise stated that their invention included modifications of the form described in their specification.

Mr. Aston, in summing up the evidence for the defendant, separated the points of law from those of fact, and submitted to his Honour four points. 1. That there was no evidence of infringement to go to the jury, the defendant not using the only combination which the plaintiffs were entitled to claim, as he did not use the partition common to two cells, and supporting its neighbours. 2. That the only evidence of alleged infringement is as to the use of parts not named in the pro-



visional specification. 3. That the six parts used by the defendant, and alleged to be an infringement of the plaintiffs' patent, were used by Billiter for a similar purpose, for low pressure, and the alterations were only such as an ordinary workman would make, to adapt the machine for higher pressure. The plaintiffs' combination was no subject matter for a patent, being only an obvious use of a known combination to effect a known purpose. 4. That the nature of the invention, as stated in the provisional specification, has been departed from, by the importation of new matter into the final document; also that the latter does not particularly describe and ascertain the nature of the invention by distinguishing the parts claimed as new from that which is old.

The details of the case, of which the above is a brief outline, will be found in the following elaborate

#### SUMMING UP.

**THE VICE CHANCELLOR:** Gentlemen of the Jury,—You have given such patient attention to this somewhat long investigation, that I believe my task will be very light when I direct your attention to the issues of fact upon which I shall wish to have your opinion, with a very short explanation of the state of the law with reference to each particular issue, in order to guide you to your verdict, when you have satisfied your own minds on a given state of facts applicable to the law, which I must explain to you, with reference to each particular issue.

The first issue, and the only one which requires any degree of minute explanation, is this—Did the Queen grant the letters patent, dated 14th July, for the alleged invention, as described and claimed by "William Needham and James Kite, in the specification of the letters patent, granted to them, for improvements in machinery and apparatus for expressing liquid and moisture from substances." The question of law which is involved in it is this—the Queen has granted these letters patent for a certain invention, and you have heard an argument from Mr. Aston, which tends, as he thinks, to establishment, that when these gentlemen lodged their provisional specification, they had not really invented that which they professed to have invented, and that they did not, in truth, invent that which they professed to have invented until six months afterwards, namely, the 23rd December, 1853, when they lodged their complete specification. If it is proved, to the satisfaction of the jury, that an alleged inventor has done this—that knowing that the whole world is alive to a certain description of improvements—that valuable rights may be secured and valuable property may be secured to him by doing his best to ex-cogitate some sort of improvement, but not having arrived at the point, he casts a wide net, and applies to the Queen to have letters patent, and lodges a provisional specification, purposely obscure, purposely framed to hide his ignorance,—in fact, so that the jury can arrive at a satisfactory conclusion, in their own minds, on the facts before them—that when he so applied and lodged that provisional specification, he had not any definite idea at all as to the improvements which he takes out the letters patent for, that will justify the jury, on this first issue, in returning their verdict for the defendant. On the other hand, you must remember, it is quite sufficient if they had invented a mode of carrying into effect a new process of a manufacture, that the whole thing has been invented by them, although they had not brought all the details of it into that complete and perfect state for working, which afterwards, by their general specification, they described. It is quite true, as the learned counsel for the plaintiff has told you, that the Act of Parliament does, in effect, make this distinction—that the provisional specification is to be a specification in which he shall describe "the nature of the invention," which, in itself, is in its terms general. It is not expected of him that he should describe, in detail, what the invention is, but he

is to describe "the nature of the invention;" whereas, when the letters patent themselves are granted, and when what is called the complete specification is prepared, then there is contained, in the grant of the letters patent, a clause, which makes them absolutely void, if the specification, which is a complete specification, is not lodged within six months, and shall particularly describe and ascertain the nature of the invention—not merely shall describe the nature of the invention in general terms, but in particular "ascertain and describe the nature of the invention, and in what manner the same is to be performed." These last words do not occur at all in the description of the provisional specification. There is nothing there required as to the manner in which the thing shall be performed. All that you are to know is, that he has described the general nature of the invention—honestly described something which he had honestly found out, and that he is not afterwards, at the end of six months, inventing the thing for which he first took out his letters patent.

In this case, gentlemen, you have had the two plaintiffs called, and it was very competent to the learned counsel on the other side to have asked either of those two gentlemen the question, plainly and simply—Had you, when you took out your letters patent and lodged your provisional specification, arrived at the conclusion which you arrived at in your subsequent complete specification? Now the learned counsel, Mr. Karlake, did ask Mr. Kite the question, and Mr. Kite answered, "I really cannot tell whether I had made my model when I took out the letters patent; but I had invented it; and I am certain we had made our model some time before taking out the complete specification." That was his evidence. Then you saw the other witness, Mr. Needham, and I confess, that I was struck with the fact that, when Mr. Needham was put into the box, he was not asked one question in cross examination. It will be for you to say whether, supposing you really discovered in the provisional specification that which will bear out the complete specification, then you have, also, further to enquire whether, in reality, these gentlemen, when they lodged their provisional specification, had or had not made the discovery. You will bear in mind that they have tendered themselves for cross examination; that one has sworn he had done so, and the other has not been asked a question on the subject, and it will be for you to consider, under these circumstances, whether they have been carrying on that which, in truth, would be a fraud on the law officers and the crown, of making a complete specification of that which never entered their minds when they lodged their provisional one. As regards the provisional one, the argument has been of this description—You never thought of that which you say is now a point of great importance—the joining of those chambers, and affording mutual support, which these chambers afford to each other. Then, they reason it thus:—The provisional specification says, and the heading of the title is, "Improvements in machinery or apparatus for expressing liquid from substances." Then, it says, "We take several flat pieces of wood, or other suitable material, of a convenient form, length, and breadth, and cut grooves and channels on both surfaces." Now, this is the important part—"We place these pieces in a strong frame, supporting each piece by placing other pieces of wood or other suitable material at the end; the sides being entirely or partially open or closed, according to the nature of the substances operated upon."

Then they proceed to describe what there is no dispute about:—"We then place between each part of the flat pieces a cloth or cloths, or other suitable material, connected with a pump." You have the argument of the counsel upon it, and you have heard the evidence they avail themselves of—Mr. Carpmael's evidence especially. They say you do not point here to anything whatever that is different to what you will find in Billiter's arrangement. Billiter's had the supports which are upon the sides; but then, when Mr. Carpmael is pressed in cross examination, he does not find in Billiter anything analogous to this part—"supporting each piece by placing other pieces of wood, or other suitable material, at the end; the sides being entirely or partially open or closed." Gentlemen, you do not find, and that is beyond all dispute on the

evidence, that there is any contrivance whatever for supporting these flat pieces of metal by pieces of wood at the ends of those pieces of metal. The only way which support is communicated is this, that there are iron pins, which run through the sides and pass through—supposing the top and bottom here (describing) to be the tin flat slabs, there is nothing supporting the ends in Billiter's. But then, Mr. Carpmael says, "But still, merely saying support does not indicate at all that you are going to form any chamber or any cell;" and he puts his evidence in this way—he says, "You might support the end"—following the exact words—"you might support the end by placing other pieces of wood or other suitable material at the end—for instance, placing a block of wood or a block of iron at the corners, so that the two ends would rest each of them at these four corners on these four ends." Then, he says, you tell me that the sides are to be partially opened or closed, according to the nature of the substance. But, on cross examination, Mr. Carpmael stated, in answer to Mr. Hindmarch, that his mode of suggesting the supporting of the ends by a piece of wood at this end and a piece of wood at this, with the sides open in certain cases, that that would be covered by the provisional specification, that you have, therefore, enough in the provisional specification to cover these end pieces so put up. Of course, when it says that the sides may be open or closed, you have enough to cover your complete box. They might be open, it is true, but they may also be closed. You have enough, therefore, to cover the whole of the chambers.

With regard to one distinction that Mr. Carpmael made in his evidence upon the term "ends and sides," I think, when you read the provisional specification, you will have no doubt that he is speaking of a four-sided figure. He speaks of two ends and two sides, and does not mean to call them all sides, but he means that two are to rest on two ends in some way or other, and the sides may be partially or wholly open, or partially or wholly shut; therefore, these sides might be, no doubt, either totally or partially open, and the two ends might be supported by these blocks, and they might also be all shut up; they might also be all closed the whole way round.

Now, it is for you to answer whether or not the fact of this gentleman not fully describing the whole, complete form of this chamber or cell, satisfies your minds, notwithstanding his evidence, that he had no idea at all of having any cell or any chamber when he took out his provisional specification; because, if you are satisfied that he had not that in his mind, that which he had claimed in his full specification—the use of these chambers and cells,—it is not proved to you that he had not it in his mind; the burden of proving it being on him. But you are to be satisfied that he had it in his mind, you are to be satisfied by the circumstances of his not saying more than he has said in his provisional specification, you are to be satisfied in your own mind—notwithstanding what he has sworn to, notwithstanding his co-partner has not been cross-examined on the subject—that he had nothing in his mind of that which is the complete specification; of course, if you are satisfied of that, they have deceived the Crown, and are not entitled to a grant. If you come to the conclusion that these words are sufficient to let in the closing, they being sufficient for that purpose, and that these gentlemen, having deposed to what they had invented at the time of applying for letters patent—if you are satisfied of these two circumstances, that they honestly applied for, and honestly had in their minds this part of the complete thing, this division at chambers, at the time they applied for their letters patent,—then, upon that issue, your verdict will be for the plaintiff.

The next issue will be the common issue,—namely, whether or not the patent was new. The defendant says, it is not new. Now these seven specifications have been put in. I dare say you will not want me, after your patient attention, to go through them in detail. Sutherland's we have hardly heard a word about; it really comes to this—that he bored holes with wire, which he put here; it is not commented upon by the learned counsel, and I think I may pass by that. Then you come to the two of Schroder's. The first of Schroder's was for

hanging bags, and preventing the bags being injured, by squeezing against each other, by putting them into a sort of semi-box, or box with no bottom. That was in 1824. In 1840, he found they burst sometimes at the bottom, and then he put them wholly in boxes, and he hung them from the ceiling, which I should not think will strike you as being in itself anything at all like the plaintiff's present machine. All these things, of course, are steps towards invention and discovery. Then the next thing is Pontifex's. Now, the important part of Pontifex's is really this:—he seems to have been the first who thought of severing the solid from the other part (the liquid), by using a force pump, and forcing the semi-fluid matter, which was to be separated, into a box, which contained a quantity of loose silk or other fibrous material. That, of course, again, was a step in the direction of discovery; but I think you will hardly require me to dilate long upon that, because you had the evidence of a very intelligent man, Mr. Barton (Pontifex's foreman), who made it a part of his duty to enquire whether his master was injured by the patent process of the plaintiffs. He said, we satisfied ourselves that the plaintiffs' process was not Pontifex's process, and therefore he was not injured by the plaintiffs taking out a patent, and the plaintiffs had a perfect right, in his judgment, to do so. Of course, this gentleman's opinion will not bind the defendant or anybody else, but as far as the evidence goes, it is strong evidence on the subject, and it is for you to say whether you are satisfied that that process of simply pumping into a box, containing fibrous matter, is at all analogous to this pumping into bags, which we have now before us.

The next in order comes the patent of Billiter. It is dated in 1843. You have seen it and heard it described, and you must be tired of the description; but you will find there is a great contest on this question about chambers or cells. Now, in Billiter's patent, you will have seen that he gets as far as this, that he has compartments—I use, purposely, a word about which there will be no question—he has compartments, in which compartments he lays his bags, and over each bag is put a wicker, through which the matter in the bag may filter; and in one of his processes—in one which is stated to relate to a stronger pressure—he puts iron plates over these wicker plates, and he ties the whole thing together by these uprights, which may be called, if you like, tie bars, and then he keeps down his iron bar by these things, which he calls pins. Some of the witnesses have told you that they consider that the very word pin would indicate that it was not to be very strong; Mr. Bramwell, I think, made that statement, and showed that a pin was not for the purpose of resisting any considerable pressure; but the apparatus, such as it is, is confined to that, and is not closed at the sides, and really they do not rest upon or support each other. That, I think, witness after witness has stated. Then the question came to be this. There is a great contest about this word cells, and no doubt you will find it to be of importance to this enquiry, because it is now time, I think, for me to tell you what the plaintiff in truth claims as his invention. The plaintiff says this:—He describes his arrangement, and he describes his slabs as made of wood or other fibrous material. "The number of slabs," he says, "are regulated by the requirements of each particular case. In the slabs are cut rectangular grooves or channels, the transverse sections of which will vary accordingly to the nature of the material or materials used, singly or in combination; and, in some cases, it may be found necessary to give a curved form to these sections." Then, he says, "The grooves are made to extend from end to end of the transverse sections of the cross timbers, and are shown in both the elevation and longitudinal sections at A, B, and C, c. The lower grooves are made for the purpose of allowing the liquid or moisture, when expressed, to escape;" that is when the thing is arranged horizontally. Then there are grooves below, for the liquid. There are upper grooves, to allow the air to pass out; and he thought it better, in order not to weaken the wood, that the proportion of air grooves should be about ten to one, as shown in the drawings, making a difference between the quantity of air grooves and liquor grooves.

Then the slabs are placed one over the other, and the cloths are introduced; and then come these words, which are very material, at page 4, line 15 :—"This arrangement of the slabs, with the cloths, or other textile fabrics or materials, and laths or blocks between them, being placed one upon another, form chambers or cells E, E, E, E, and are bound together by a strong frame of wood, metal, or other material, according to special requirements of size and strength;" therefore, he distinctly claims a combination, in which he introduces these several things. He introduces slabs, he introduces laths or blocks at the sides, which are to support them, and are to form them into chambers or cells. Then he has an ingenious apparatus, by which there is a pipe from each bag; that bag is screwed on to a service pipe, that is connected with an upright pipe, that is fed by means of a pump; therefore, you can feed that or any of the successive layers, in the manner you find most convenient to be adopted. Now, as regards the service pipe and the upright, Billiter had nothing which satisfied the operation of these cells or chambers in the sense in which I use it. He had a compartment, which I have spoken of; but a question has arisen on the words cells or chambers. Now Mr. Carpmael first said, "That is a cell, and here is another down here; there is nothing connecting them except the bag; and when the bag is full, the whole thing, bag and all, may make the cell:" but, he said, "that, I call a cell;" then, that term appearing to be a doubtful one for it, I asked him to describe what there was in Billiter's, and he said clearly, and distinctly, and fairly enough, that there was nothing of the kind forming cells or chambers, in that sense, confining the closed matter in which the bags were put; and he said it was of the greatest importance that, when you have high pressure, you should protect the bags from squeezing of this kind. He said it was so obvious, that any man would do it. As a matter of fact, Billiter has it not, and the plaintiff has it.

Then the plaintiff says, as regards his claim, that "We do not claim the exclusive use of any of the parts, taken as parts of the machinery described and shown," that is to say, we do not, by our patent, claim any one of these single parts; it is a matter, therefore, of the utmost indifference whether they were invented before or not. We do not claim them as part; therefore, every single part may be invented separately. But they say, "We claim them only in so far as the same is used in combination for the purposes of our invention, which we declare it to be, and we claim the sole use of the combination of parts herein-before described." That is to say, a box is not new in itself, a feed pipe is not new in itself, a tie bar is not new in itself, and so, I think, he went through every single part that was used. But, he says, nobody ever before put all those things together for obtaining pressure, which I have done. That is the whole that I claim. Now, commenting on what Mr. Carpmael said on the word chamber or cell (because that is an important word in the plaintiffs' specification, as you do not find the same thing in Billiter's) it is very important for you to bear in mind a single phrase that dropped from Mr. Spence, who said, "I agree with Mr. Carpmael in everything except his definition of the word 'chamber.'" He said, "I should, by the word 'chamber,' always understand something enclosed." It is for you to consider what the weight due to that evidence may be. You have this evidence on the part of Mr. Carpmael and Mr. Cowper, who both say this upon the question of infringement, which we shall come to more particularly presently. Mr. Aston went through all the things of the plaintiff and defendant, and Mr. Carpmael both answered, step by step, and stated that they were all in Billiter's. "Chambers and cloths" were the first. Then you must take that explanation of the word "chambers," with what the witnesses for the plaintiff have said, that they do not consider that there are any chambers at all; and with the evidence of Mr. Spence, who says, "I should consider a chamber a closed thing." That you will have to consider and to weigh when we come to what Mr. Carpmael and Mr. Cowper say, that chambers are in Billiter's machine. You now know what they mean. They do not mean anything enclosed like the plaintiffs. They mean what you see there; it is not supporting

itself, and is not closed. It will be for you to say, under the circumstances, whether you consider Billiter has in any way anticipated the plaintiffs' discovery.

Now the only remaining machine is that of Durnerin's. Mr. Bramwell, and several other gentlemen called for the plaintiffs, very fairly said, in principle that is nearer the plaintiffs' than any other, because it has the fluted surfaces, it has the bags, it has the force pump, and in these respects it is similar to the plaintiffs'. But not only is it not combined as a chamber with other chambers, supporting each other, but you cannot combine them; therefore Mr. Durnerin hooped his round with iron, and the only way in which Mr. Cowper answered that observation of Mr. Bramwell was this, that he said if you imagine Durnerin to squeeze his cylinder down flat until he gets it like a cheese, and then makes it rest against other cylinders, all equally squeezed, you get the plaintiffs' cell. I asked him a question upon that. I said, in that case you would dispense with all the core in the centre, and you would dispense with all the iron hoops; in fact, you would have made a totally different instrument. That Mr. Cowper agreed to, that the core would be dispensed with, and the hoops would be dispensed with. I think some other witness has said this morning that you need not take out the core, but of course you would want the iron hoop (which I shall for a moment let stand by itself), and not a series of cells or chambers, which the plaintiff has described. Now all the plaintiffs' witnesses have said, and I do not think any contradiction has been given by the defendant, that the fact of putting the chambers one upon another, and supporting each other, is of importance in two ways; first, because they each take off the pressure coming on the tie rods. Another advantage is the facility of taking out the material.

Then there is this important fact to consider, when you come to the question of novelty. I took the liberty of putting, it appeared to me, a question one ought to put, to the plaintiffs' witnesses, who were called, and to the defendant's witnesses, and they all agree in this, that until the plaintiffs' machine was brought into use, they never saw anything like it. Now, you have this circumstance, that if it be simply the same thing as an ordinary workman would do with Billiter's, that was invented ten years before the plaintiffs took out their letters patent, ten years were given to all the workmen in the kingdom to put their heads together, and find out what would be the best way of making a machine for squeezing and filtering in that way. It is said high pressure was not wanted, but yet a part of the case of the defendant's is that part of the machine of Billiter indicates high pressure; but I think it is for you to bear in mind the argument of the learned counsel for the plaintiff, when he said—society is always going on wanting what it can get in the way of any improvement, of any sort, in any machine. If you do find that the plaintiffs have been allowed to pocket large sums of money by their patent during the five or six years of its use, and nobody has used anything like it until the defendant's machine, for the purpose of interfering with the plaintiffs' invention, it is for you to consider whether the addition of these chambers—which enabled this high pressure to be used, and the whole combination of the whole machine as described, comprising, as it does, these chambers—is or is not, a new invention. That is all I need say on the subject of novelty.

Then you come to an important question for the defendant. Has he or has he not infringed? Now, perhaps one ought to call attention, in the first instance here, to the defendant's own evidence, which has some bearing, perhaps, also on the question of novelty—the defendant's own evidence of his interview with Mr. Kite. He said you have only made a step in advance, but the time has come when more improvements should be made—people want them. I have invented something very valuable and useful. And then he said, "I had a little further talk with him as to whether we could not avoid competition by means of mutual licenses." You have, therefore, the fact that he did, in a sense, say to avoid competition, to avoid legal difficulties, and legal consequences, he was glad to take a license, if it could be arranged. "I said, if he would take one from me I would take one from him, but I never intended

to take a license otherwise." "But," he said, "you have made a step in advance." The way he tried to explain that was this. He said it was a little complimentary speech; but, "the step in advance" is the whole gist of the matter, whether there is an invention or not. If there is a step in advance, it is new, and it is for you to consider whether it is to be taken only in that complimentary sense, or whether you would consider that, coupled with the other evidence, to be an admission of novelty on the part of the defendant.

The next point is that of infringement, and I have not certainly heard any evidence that goes to the difference, beyond this: there is a difference in the air pump, instead of a common force pump; there is the difference of laying the wire over the bottom surface. I have not said a word about its being horizontal or vertical, because it is admitted the plaintiff has a right to turn it up if he pleases. Then there is a wire put down, which is not in the plaintiffs', over the bottom surface. That bottom surface is not cut into grooves, but it is laid on in small strips of wood, which the defendant and his witnesses say are merely bearing substances to bear up the wire. Then there is another difference, much urged this morning—I have not heard it before—namely, that there is the closing of the upper part of each chamber or compartment, so as to make it a box; whereas, in the plaintiffs', it is a series of compartments, with one board placed on a bag—supposing there was a bag here, and there was a board here, and there was a bag here, then another board and another bag, and so on; whereas, in the defendant's, between each set of bags there were two boards. Still, the bags being put into chambers, which are made more like shelves, the thing fitted the shelf and then closed up the sides. These are the differences which are pointed out, and Mr. Aston has told you two or three times that he relied very strongly indeed on them. He opened his case on the legal part of the case on Mr. Bramwell saying, "Take away the supports in the plaintiffs' machine, and then you have Billiter's." Well, but the supports, in truth, are everything, and it is not whether it is one board, or two or three, it is the resting and supporting that is everything; and in the passage quoted to you this morning by Mr. Aston, though he did not repeat it in his argument, it was, "Take away the blocks," which was the second expression Mr. Bramwell used—"pull out these wires from Billiter's, and take the plaintiffs' blocks, and then you bring the plaintiffs' down to Billiter's." So far, of course, that would be true. Then you have the evidence of Mr. Cowper, which I have already once referred to, upon a different branch of my summing up. The evidence of Mr. Cowper and Mr. Carpmael was, that taking thing by thing, first the chamber, then the pump, then the bag, and all the things that were gone through, all those existed in Billiter's, and therefore the defendant has a right to have them. If that is made out, it will be for you to consider whether there is anything in the shape of chambers in Billiter's at all. In the defendant's you have chambers, which the plaintiff has, and Billiter has not. If you come to the conclusion that Billiter has not the chamber, then you are reduced in truth to the particulars I have mentioned, which I said are,—this wire, which the plaintiff admits at once is not in his; you have then the supports of the wire and the double sides making the bags instead of making the shelf between the two partitions. Now I am bound to tell you this, as a point of law, supposing you are satisfied in your own minds from anything that had actually occurred in the course of the evidence that the defendant's is a machine very much better than the plaintiffs', still, if it has the same parts as the plaintiffs', the defendant has infringed. The defendant is not entitled to take the combination of the plaintiff and improve it. He must wait until the plaintiff's patent has expired, and then he may use all the improvements; but he cannot take the plaintiffs' contrivances and superadd his own matter. Therefore, as far as the wire is in addition, you may dismiss it from your minds—the wire may be put altogether out of consideration. What you have to consider is, whether by using that wire, he has so done away with the use of the plaintiffs' combination—if you think he has used it at all—as to justify you in saying he has not infringed. Now the

pump he has got is not the same undoubtedly,—he has a service pipe; he has a cock serving the pipes. I will speak of the grooves presently—I will not forget them. He has the separate chambers, only they are made in a complete box, so that there are two pieces of wood between each set of pegs—inside the one. He has all these things except the question of the grooves.

Now the grooves, many of his witnesses say he has not got, and that is made out in this way: the pieces that are nailed on are for supporting the wire. That might well be; still you will be left to consider whether the spaces or the channels so left by these support-rods do operate in the same way or manner as the plaintiffs' grooves, in carrying off the liquor. You have this fact to bear in mind, that the defendant himself says, if I put my wire flat on the board I shall not do anything at all,—I shall not drain at all. Of course he would not, because it would be merely squeezing upon the wire and squeezing upon the flat board. It is for you to say whether you consider these pieces of wood formed for the support of the wire, do form such an equivalent to the grooves which are used by the plaintiffs in their apparatus as to render the machine of the defendant in effect the same as the plaintiffs', with any little additions or improvements; but mere additions or improvements will not in themselves make it a new machine. With the exception of the grooves, I do not think anybody has said that the defendant has not got everything which the plaintiffs have, except the grooves and the different shaped pumps.

I do not think there has been any substantial difference between any of the engineers who have been called. Then, as regards the use of the apparatus, you have had very much evidence on the part of the plaintiffs as to its use. They have given you evidence from the wine trade, the beer, the oil trade, the pottery trade, and the mixing of colors. They have given you five instances in which this apparatus is used successfully, and everybody would admit that it is useful, and in breweries it is very largely used.

This one fact you will certainly bear in mind, in considering the whole question deliberately and candidly, as I am sure you will on both sides—that up to the plaintiffs' no such machine as the plaintiffs' had been used. That is a strong fact on the one hand; and up to the defendant's, none like it, in the ten years intervening between Billiter's and the plaintiffs', no machine was made like the plaintiffs'; and during the ten years that intervened between the plaintiffs' and the defendant's none had been made like the plaintiffs' except the defendant's own.

Taking all these circumstances into consideration, and the interview which the defendant had with the plaintiffs, and what he then said, whether you come to the conclusion that it is an infringement or not, will depend partly, of course, on what value you will give to these specific things, pointed out by Mr. Carp-mael, Mr. Cowper, and the other engineers, and the witnesses whom I have referred to, because really no other witnesses have been called on the part of the case—the infringement: you will consider what they have said, as making out in their judgment that there is infringement, or that there is no infringement; as to defendant's and the plaintiffs' both being just like Billiter's, what they have said with reference to this, that if the defendant has infringed, the plaintiffs may be said just as much to have infringed Billiter's; how far you consider it to be a fair improvement on Billiter's, just as the plaintiffs was a fair improvement on Billiter, or whether you consider that the defendant has, in effect, borrowed his from the plaintiffs, taken his idea from them, and invaded their patent.

The jury, after a short consultation, gave a verdict, on all points, for the plaintiffs.

Solicitors for the plaintiffs Messrs. Pyke and Irving; for the defendant Messrs. Harbin and Smith.

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## Provisional Protections Granted.

1863.

[Cases in which a Full Specification has been deposited.]

1218. George Tomlinson Bousfield, of Loughborough-park, Brixton, impts. in machinery for rolling, grinding, and cutting files and rasps,—a communication.—*May 14th.*
1282. William Snell, of Clement's-inn, impts. in butt hinges,—a communication.—*May 22nd.*
1341. Charles F. Baxter, of Boston, America, a hollow elastic stopper for bottles, jugs, and other similar vessels.—*May 28th.*
1418. Gustav Wilhelm Eduard Friederich, of Shap-street, Kingsland-road, the manufacture of a new ink.—*June 8th.*

[Cases in which a Provisional Specification has been deposited.]

192. Heinrich Caro and John Dale, of Manchester, impts. in obtaining coloring matters; part of which impts. is also applicable to dyeing and printing.—*January 21st.*
451. Richard Percy Roberts, of Kennington Oval, impd. axle boxes for carriages or vehicles,—a communication.—*February 19th.*
502. William Edward Gedge, of Wellington-street, impts. in the manufacture of hats,—a communication.—*February 24th.*
554. John Ambrose Coffey, of Providence-row, impd. method of, and apparatus for, controlling and facilitating locomotion, whether on land or on water.—*February 27th.*
603. Jean François Gits, of Antwerp, impd. furnace for the revivification of animal charcoal.—*March 4th.*
648. Henri Adrien Bonneville, of Paris, a new aromatic vinegar, for removing stains from cloth and other materials,—a communication.—*March 9th.*
751. John Brigham and Richard Bickerton, of Berwick-upon-Tweed, impts. in reaping or mowing machines.—*March 20th.*
787. Louis Christofleau, of Paris, impts. in fire-arms.—*March 23rd.*
845. William Henry Phillips, of Nunhead, impts. in means or apparatus for cleaning the bottoms of ships or other floating vessels.
853. Astley Paston Price, of Lincoln's-inn-fields, impts. in apparatus employed in the fusion, manufacture, production, and refining of metals.
- The above bear date April 2nd.*
867. William Edward Gedge, of Wellington-street, impts. in aerial machines,—a communication.—*April 6th.*
918. Walter Samuel, of Liverpool, impts. in, or applicable to, railway carriages, to mitigate or lessen the effects of collision to passengers.
919. James Farrar, of Halifax, impts. in machinery or apparatus for twisting or doubling yarns of wool or other fibrous substances.
920. William Clark, of Chancery-lane, impts. in separating ores from their gangues, and in apparatus for the same,—a communication.
921. Price Prichard Baly, of Robert-street, Adelphi, impts. in constructing breakwaters, piers, sea walls, and other similar structures.
922. Alexander Fortay Maclure, of Glasgow, impts. in looms for weaving figured fabrics.
923. Charles Atkins Collins, of Trowbridge, impd. method and apparatus for loading carts and waggons with hay, straw, and other similar products.
- The above bear date April 11th.*
924. John Ramsbottom, of Crewe, impts. in machinery for hammering, rolling, and shaping metals.
925. John Gill, of Edinburgh, impts. in printing machinery.
926. Alfred Rolfe, of Amwell-street, impts. in means or apparatus for propelling carriages on railways, tramways, or on common roads.
927. Robert Leggett and Robert Gittus, of Mildenhall, Suffolk, impts. in the construction of machinery or apparatus for cutting chaff and other agricultural produce.
928. James Lark, of Bankside, impts.

in the manufacture of artificial fuel and cement.

929. Robert Reeves, of Bratton, Wilts, impts. in the manufacture of liquid manure drills.

930. Robert Newton, of Leeds, impts. in machinery for separating and straightening the fibres of silk waste and other fibrous substances.

931. Michael Myers, of Wigmore-street, impts. in the construction of trunks, portmanteaus, and boxes.

932. Thomas Mallinson and Peter Williams, both of Manchester, impts. in machinery for opening, cleaning, carding, and grinding, or sharpening cards used in preparing cotton and other fibrous materials.

*The above bear date April 13th.*

933. John Nasmyth and Samuel Thornton, both of Manchester, impts. in machinery for carding cotton and other fibrous substances.

934. George Berry, of Bultesland-street, Hoxton, impts. in locks.

935. George Thomas Smith, of East Retford, Nottinghamshire, impts. in metallic window-shutters.

936. William Keats and John Keats, both of Street, Somersetshire, impts. in the manufacture of boots, shoes, or other coverings for the feet.

937. John Combe and John Henry Smalpage, both of Leeds, impts. in the action and arrangement of machines for winding cops, in the construction and arrangement of banks for holding cops for warping purposes, in the formation of shuttles for receiving cops, and for apparatus for packing and securing cops in shuttles; one part of which impts., consisting of a spring clutch, is applicable to machines in general.

938. John Keats and William Stephens Clark, both of Street, Somersetshire, impts. in sewing machines.

939. Henry Trapnell, of Bristol, impts. in vent pegs.

940. Richard Archibald Brooman, of Fleet-street, impts. in hardening and coloring gypseous limestone and sand, and calcareous stones,—a communication.

941. Richard Archibald Brooman, of Fleet-street, impts. in lamps for burn-

ing light and heavy mineral and vegetable oils,—a communication.

942. John Smith, of Edward-street, Bow-road, impts. in furnaces and boilers for the generation of steam; partly applicable also to other purposes.

*The above bear date April 14th.*

943. James Leach, of Cheadle, an impd. machine or apparatus for washing, squeezing, mangling, and churning.

944. Ewing Pye Colquhoun and John Pardoe Ferris, both of Laurence Pountney-hill, impts. in fire-bars for the furnaces of steam boilers and fire-grates.

945. Thomas Gray, of Lower Mitcham, impts. in preparing and bleaching flax, hemp, and other vegetable fibres, by which a brilliant lustre is imparted to those substances and the fibres are separated.

946. William Clark, of Chancery-lane, for impts. in apparatus for the transport of goods,—a communication.

947. Henri Adrien Bonneville, of Paris, impts. in the construction of gas burners,—a communication.

948. Ambrose Marriott, of Higham Ferrars, Northamptonshire, impts. in boilers for heating buildings, and in regulators for the same.

949. William Spence, of Chancery-lane, impts. in the manufacture of gunpowder,—a communication.

950. Henry Eaton, of Manchester, impts. applicable to presses for baling purposes.

951. John Sanderson Morton, of Northampton, impts. in locks.

952. Alfred Vincent Newton, of Chancery-lane, impd. construction of blowing apparatus,—a communication.

953. Thomas Bell Elcock Fletcher, of Birmingham, impts. in apparatus for collecting the solid portions of sewage.

*The above bear date April 15th.*

954. John Burchley Watts, of Birmingham, impd. in steel sword hilts.

955. John Laird McLay, of Liverpool, impts. applicable to mariners' compasses.

956. Isham Baggs, of Cambridge-terrace, Middlesex, and William Simp-

son, of Tovill Mills, Kent, impts. in purifying and treating coal gas, sulphuretted hydrogen, and other gases containing sulphuretted hydrogen, and in obtaining sulphur, sulphuric, and other acids in such treatment.

957. Charles Terrett, of Bristol, impts. in preventing incrustation in steam boilers.

958. Stephen Moulton, of Bradford, Wilts, impts. in apparatus or means for lessening the recoil of cannon.

959. William Oldfield, of Noble-street, Saint Luke's, impts. in the construction of locks, applicable to despatch and other boxes, writing and dressing cases, or other similar receptacles.

960. Alexander Samuelson, of Cornhill, impts. in the construction and arrangement of machinery and apparatus for the manufacture of oil.

961. Thomas Alfred William Clarke, of Leicester, imps. construction of shuttle driver, and apparatus for working the same.

962. François Antoine Edmond Guirounet de Massas, of Hoxton, impts. in smut machines, and in machines for cleansing and peeling grain and seeds.

*The above bear date April 16th.*

963. Richard Knight, of Dunkirk, France, impts. in treating and preparing iron, copper, and other wires, for telegraphic and other uses, for the purpose of preserving them from corrosion or decay.

964. Samuel Riley, of Oldham, impts. in the manufacture or preparation of cocoa and chocolate.

965. James Richmond, Thomas Richmond, and Daniel Harling, of Burnley, impts. in looms for weaving.

966. John Goucher, of Worksop, Nottinghamshire, impts. in steam boilers, and in regulating the admission of air into the furnaces of steam boilers.

967. Robert Calvert Clapham, of Walker, Northumberland, treating the waste liquors from bleaching powder stills, in order to obtain hydrochloric acid and other products therefrom.

968. Robert Henry Lawson, of Vic-

toria Docks, and William Darlow, of Victoria-place, North Woolwich-road, impts. in apparatus or means for obtaining motive power.

969. William Massingham, of Boston, Lincolnshire, impts. in apparatus for cooling liquids.

970. Cornelius Turner, of Hunslet, Leeds, impts. in the manufacture of felted fabrics.

971. Bernard James Webber, of Newton Abbot, impts. in apparatus for separating corn from the ears, and for combing straw.

*The above bear date April 17th.*

972. Charles William Siemens, of Great George-street, and Frederick Siemens, of Birmingham, impts. in furnaces which are principally applicable to the smelting of iron.

973. William Stevenson Macdonald, of Manchester, impts. in apparatus for drying animal, vegetable, and mineral substances.

974. Thomas Aldridge Weston, of Birmingham, impts. in ratchet levers.

975. William Benoni Burden, of Malvern, impts. in wheels and axles applicable to locomotives, carriages, and paddle wheels.

976. Gustav Adolph Buchholz, of Montague-place, Clapham-road, impts. in apparatus for hulling grain, and for reducing granular substances.

977. Thomas Hunt, of Banbury, imps. apparatus for obtaining motive power.

*The above bear date April 18th.*

978. Philip George Rowell and Henry Holt, both of Brighton, a better and more economical mode of securing the bands of locomotive engine and tender springs; also a new method of applying the same.

979. Charles Randolph and John Elder, of Glasgow, impts. in surface condensers.

980. George Graham, William Graham, and John Graham, all of Burnley, impts. in machinery for folding or plaiting fabrics.

981. Claude Blanc, of Paris, impts. in apparatus for the purpose of using air and steam as motive power.

982. James Robey, of Newcastle-under-Lyme, impts. in apparatus for

- separating fluids from more solid matters mixed or combined therewith.
983. William Edward Newton, of Chancery-lane, impts. in lamps,—a communication.
984. Ebenezer William Hughes, of Great George-street, impts. in turntables, turn-bridges, and slips.
- The above bear date April 20th.*
985. Alfred Ford, of Stewart's-buildings, Battersea-fields, and Richard Rigg, of Great Winchester-street, impd. method of reforming and re-using old or waste vulcanized India-rubber.
986. Henry Rafter, of Coventry, impd. process for obtaining printing surfaces.
987. Joseph Heap, of Ashton-under-Lyne, impts. in adjustable wrenches for nut pipes and pins.
988. Edwin Lindsey Simpson, of Bridgeport, Connecticut, U.S.A., impd. in waterproof compounds and in fabrics prepared therewith.
990. Mark Runkel, of New York, impts. in marine steam engine governors,—a communication.
991. John William Nottingham, of Clayton-place, Kennington-road, impts. in two-wheeled vehicles.
993. Hugh Donald, of Johnstone, Renfrewshire, impts. in machinery or apparatus for bending or straightening metal plates.
994. William Edward Newton, of Chancery-lane, impts. in wrenches,—a communication.
995. William Colborne Cambridge, of Bristol, impts. in the construction of harrows.
996. William Campion and George Wilson, of Nottingham, impts. in machinery or apparatus employed in the manufacture of looped fabrics.
- The above bear date April 21st.*
998. Frederick Edward Bryant, of Alfred-street, Bedford-square, impd. apparatus for ascertaining the temperature of steam, and its power of tension,—a communication.
1000. François Durand, of Paris, impts. in moulding articles of china or other clay, or of other plastic materials.
1001. Theodore Grace, of Bristol, impts. in reaping and mowing machines; part of which impts. is applicable to other useful purposes.
1003. Edward James Jeffs, of Brighton, and Thomas Turner, of King's-road, Chelsea, impts. in the making and constructing of carriage way.
1005. James Lee and Edwin Dawson, of Tammerfors, Finland, impts. in looms for weaving.
1006. Gill Bridges Barber, of Manchester, impts. in steam boilers and apparatus connected therewith.
- The above bear date April 22nd.*
1007. John William Proffitt, of Park-road, Peckham, and William Lundy Duncan, of Pembroke Cottages, Caledonian-road, impd. mode and apparatus for distributing sand, or any other suitable substance or substances, on the rails of railways and tramways.
1008. Joseph Whitley, John Buckingham Pope, and John Watson Burton, of Leeds, impts. in the manufacture of metals.
1009. Robert Richardson, of Great George-street, Westminster, impts. in railway permanent way.
1010. William Edward Newton, of Chancery-lane, impd. mode of repairing worn-out files, and rendering them again fit for use,—a communication.
1011. William Clark, of Chancery-lane, impts. in the manufacture of tiles, and in apparatus for the same,—a communication.
1012. Thomas Richardson, of Newcastle-upon-Tyne, and James Cochran Stevenson, of Durham, impts. in the manufacture of sulphate of soda.
1013. Peter McGregor, of Manchester, impts. in machinery for spinning and doubling.
- The above bear date April 23rd.*
1014. John Cavanah, of Liverpool, impd. in cricket bats.
1015. John Benjamin Daines, of Little Argyle-street West, impts. in the preparation of stone, plaster, compo, iron, wood, and such like substances, so as to preserve them from decay.
1016. William Newton Wilson, of High Holborn, and James Graham Grey, of Cheapside, impts. in machinery for sewing and stitching.

1017. John Lambert, of Sheffield, impts. in ball cocks.
1018. John Sheppard, of Canterbury, impts. in steam engines.
1021. Philip Passavant, of Bradford, Yorkshire, impts. in the manufacture of blue coloring matter, and also of violet coloring matter,—a communication.
1022. John Cornes and John Coope Davis, of Ilford, impts. in lawnmowing, rolling, and collecting machines.
1023. James Thompson, of Bilston, impts. in the manufacture of barrels for fire-arms and other descriptions of tubes, and in apparatus or machinery to be employed for that purpose.
1024. James Thompson, of Bilston, impts. in machinery for punching metals.
1025. William Anthony Shaw, of New York, a mode of lining lead pipe with tin or its alloys.
1026. James Hinks and James Newman, of Birmingham, impts. in the manufacture of buttons.
1027. John Henry Johnson, of Lincoln's-inn-fields, a filtering apparatus, for treating, by pressure, oils, syrups, and all sorts of liquids susceptible of filtering,—a communication.
- The above bear date April 24th.*
1028. Charles Pooley, of Manchester, impts. in certain parts of machinery for preparing and spinning cotton and other fibrous substances.
1029. Leopold de Breanski, of Greenwich, impd. apparatus for fixing drills; which invention is also applicable for fixing apparatus for raising, supporting, and suspending weights, and for other analogous purposes.
1030. Samuel Harrison, of Sheffield, a new and impd. mode of manufacturing type for letter-press printing.
1031. Albert Henry Clark and Henry Hope, of Birmingham, impts. in valves for water, steam, and gas.
1032. Thomas Aldridge Weston and Charles Vivian, of Birmingham, impts. in pulleys, capstans, and other machines for raising weights and transmitting motive power.
1033. John Phillips Nunn and Edmund Brook Nunn, of Royston, impts. in hoes and cultivators.
1034. James Dunbar, jun., and John Wymen Woodford, of Sutherland-street, Walworth, impts. in apparatus for steering and manœuvring ships and vessels.
1035. Louis Alexandre Joseph Bruet, of Paris, impts. in apparatus for registering, indicating, and verifying the time and distance passed over by vehicles; also applicable to machinery, and other similar purposes.
1036. Alcide Poirrier and Charles Chappat Fils, of Paris, impts. in the manufacture of blue and violet coloring matters suitable for dyeing and printing.
1037. Frederick Walton, of Chiswick, impts. in the manufacture of fabrics for covering floors and other surfaces, and in the apparatus employed therein.
1038. Charles Beyer, of Manchester, impts. in safety valves,—a communication.
1039. Ira Dimock, of Hampshire county, Massachusetts, U.S.A., impts. in machinery for cleaning, sorting according to size, and doubling silk and other threads.
1040. Alexandre Legras, of Davies-street, Berkeley-square, impts. in machinery or apparatus for making ices.
1042. William Edward Newton, of Chancery-lane, impts. in thrashing machines; parts of which impts. are also applicable for hulling, decorticating, cleaning, and polishing grains and seeds,—a communication.
1043. Alfred Vincent Newton, of Chancery-lane, impts. in breech-loading fire-arms,—a communication.
- The above bear date April 25th.*
1045. Samuel Osborne, of Bayswater, impd. machine for unwinding crinoline steel.
1047. Hilaire Emile Carchon and Eugène François Raybaud, of Paris, impts. in the manufacture of hats and bonnets, and mode of preparing feathers to be used in the said manufacture.
1048. Jean Joseph Robert, of Paris,

- impts. in the manufacture of spoons and forks.
1049. William Edward Gedge, of Wellington-street, impts. in tuyeres or blast pipes, and in apparatus connected therewith,—a communication.
1050. Maurice Valkenhuyzen, of Paris, new castor for furniture.
1051. Westley Richards, of Birmingham, impts. in ordnance, fire-arms, and cartridges.
1052. Julius Jeffreys, of Upper Norwood, impts. in constructing surface condensers and apparatus for heating and cooling fluids.
1053. Frederick Bennett, of Holywell, Flintshire, impd. method of condensing lead and other metallic fumes and vapours from furnaces.
1054. Richard Archibald Brooman, of Fleet-street, impts. in twisting and doubling silk, and in frames employed therein,—a communication.
1055. William Henry James, of Old Kent-road, impts. in indicating the locality of fire; applicable also to denoting the position of ships.
1056. William Hudson and Christopher Catlow, of Burnley, impts. in looms for weaving.
1057. Alexander Rollason, of East Peckham, impts. in dyeing and staining fabrics; parts of which impts. are also applicable for dyeing, staining, and ornamenting glass and other substances.
1058. Henry Beare, of Newton Abbot, impts. in machines for threshing out corn from its straw; part of which is applicable for combing the straw.
- The above bear date April 27th.*
1059. Silvester Ingledew, of Stockton-on-Tees, impts. in the method of obtaining iron from its ore, and in the subsequent treatment thereof, for converting the product into a metallic state, and in apparatus connected therewith.
1060. John Marris and William Marris, of Great Grimsby, impd. machine for breaking loaf sugar.
1061. Samuel Crabtree, of Bradford, Yorkshire, impts. in halling motions.
1063. Arthur Kinder, of Cannon-street, impts. in the manufacture of sheet metal, and in ingots or plates of metal, and in the machinery or apparatus employed therein.
1064. William Clark, of Chancery-lane, impts. in machinery for the manufacture of paper and of the various kinds of boards produced from fibrous substances,—a communication.
1066. John Henry Johnson, of Lincoln's-inn-fields, impts. in drying and cooling grain, and in the machinery or apparatus employed therein,—a communication.
1068. George Samuel Macdonald, of Meard's-street, Soho, impts. in card-cases.
1069. Thomas Moore, of Leadenhall-street, impd. apparatus for laying down, protecting, and controlling submarine cables for telegraphing from vessels moored off a coast to the shore.
1070. Richard Butterworth, of Fails-worth, Lancashire, impts. in carding engines to be employed for carding cotton and other fibrous substances.
1071. George Davies, of Serle-street, impd. machine for agitating and mixing substances,—a communication.
1072. George Edmond Donisthorpe, of Leeds, impts. in apparatus used when getting coal and other minerals.
1073. Henry Young Darracott Scott, of Brompton Barracks, near Chatham, impts. in the manufacture of cementitious substances.
1074. Samuel Stephens Marling, of Stanley-park, Gloucestershire, impd. machinery for scouring, washing, and cleansing woollen cloths and other fabrics.
- The above bear date April 28th.*
1075. John Rowley, of Peckham, impts. in the means or apparatus employed for recovering the fibres of wool from fabrics or materials composed of wool combined with cotton or other vegetable substances.
1077. William Tarr and Enoch Farr, of Manchester, impt. in pianofortes.
1078. William Edward Gedge, of Wellington-street, impd. system of permanent advertisement,—a communication.
1079. Evan Leigh and Frederick Allen,

- Leigh, of Manchester, impts. in cotton gins, and in the method of driving the same; part of which impts. is applicable to other purposes.
1080. William Roger, of Shawfield-street, Chelsea, impts. in anchors.
1081. Henry Worms, of Park-crescent, Portland-place, impts. in apparatus for elevating guns.
1082. Margaret Barland, of Mount-street, Grosvenor-square, and Edward Henry Cradock Monckton, of the Cavendish Club, impts. in apparatus for withdrawing milk from cows and other mammiferæ, and for conducting it, when withdrawn, to appropriate receivers,—partly a communication.
1083. Frederick Gretton, of Burton-upon-Trent, impts. in heating the contents of mash tuns.
1084. George Holcroft, of Manchester, impts. in the construction of pyrometers.
1085. Henry William Ripley, of Cheltenham, impts. in apparatus for printing fibrous materials,—a communication.
1086. Michael Henry, of Fleet-street, impts. in apparatus for manufacturing beton and artificial stone, puging clay, and other similar purposes, and in the production of artificial stone and artistic ornamental and decorative articles, works, and surfaces,—a communication.
- The above bear date April 29th.*
1087. John Wibberley, of Manchester, impts. in machinery or apparatus for winding cotton, silk, wool, or other threads on spools or reels.
1088. Alfred Henry Rémond, of Moor-gate-street, impd. process for retaining the aroma of coffee and cocoa.
1089. William Clark, of Chancery-lane, impts. in the manufacture of hydrocyanate of ammonia, and of alkaline and earthy cyanides,—a communication.
1090. Edward Mitchell, of Fareham, impts. in reaping and mowing machines.
1091. Edward Griffith Brewer, of Chancery-lane, impts. in welding and rolling metals, and in machinery connected therewith,—a communication.
1092. Charles Patrick Stewart, of Manchester, and John Kershaw, of Duke-street, Westminster, impts. in engines, machinery, and apparatus for obtaining compressed air, and for applying the power thereof in propelling railway and other carriages.
1093. Joshua Appleby, of Manchester, impts. in propelling ships and barges.
1094. John Henry Johnson, of Lincoln's-inn-fields, impts. in rotatory engines,—a communication.
- The above bear date April 30th.*
1095. John McFarlane Gray, of Liverpool, portable apparatus or instruments for rivetting, caulking, chipping, and otherwise operating upon and treating metals and other substances.
1096. Edward Jones, of Charlton, Kent, impts. in drainage and in waterclosets, and in the means and apparatus necessary for the same respectively.
1097. William Clissold, of Dudbridge, impd. apparatus for fulling woollen cloths, and washing and cleansing woven fabrics.
1098. William Grindley Craig, of Cannon-street, impts. in feed apparatus for steam boilers,—a communication.
1099. Joseph Badart, of Bishopsgate-street, impts. in the preparation of rape seed cake, linseed cake, poppy seed cake, niger seed cake, sesseme seed cake, and ground nut cake.
- The above bear date May 1st.*
1100. Titus Lucretius Bissell, of Charleston, North America, impd. apparatus for charging breech-loading cartridges.
1101. William Thomas Smith, of Dalton, impts. in washing machines.
1102. John William Gibson and William Turner, of Dublin, impts. in springs to be used for railway buffers, drawhooks, and also for carrying springs of railway carriages and other vehicles.
1103. George Burt, of Birmingham, impts. in machinery for punching, stamping, or forging metals.
1104. James Purdey, of Oxford-street, impts. in breech-loading fire-arms.
1105. Samuel John Bartlett, of Maidstone, impts. in apparatus for straining and drawing off liquids.

1106. Jean Baptiste Dubreuil, of Paris, impts. in carts, waggons, and other vehicles.
1107. John Thomas Oakley and Thomas Oakley, of Grange-road, Bermondsey, impts. in the construction of garden pumps; part of which said impts. are applicable to fire engines and other hydraulic machines.
1108. Henry Myers, of Paris, apparatus for indicating appointments or fixed engagements.
- The above bear date May 2nd.*
1109. Edmund Richard Southby, of Wareham, Dorsetshire, impts. in the extraction of scents from plants, flowers, and other odoriferous substances.
1110. John Fortune, of Morton, near Bingley, Yorkshire, impd. means of joining or fastening together lace, blond, quilling, or similar materials.
1111. John Morris Johnson, Edmund Johnson, and Charles Johnson, of Castle-street, Holborn, and Louis Bertling, of Ironmonger-street, Saint Luke's, impts. in the production of show tablets, advertisement tablets, name plates, architectural facings and decorations, and other ornamental, decorative, and inscriptive articles.
1112. Bevan George Sloper, of Walthamstow, impts. in apparatus for separating metals from earthy and other matters mixed with them.
1113. George Haseltine, of Southampton-buildings, impts. in springs for railway carriages and other purposes,—a communication.
1114. Frank Applegate, of Bradford-on-Avon, impts. in spring balances and pressure gauges.
- The above bear date May 4th.*
1115. John Henry Johnson, of Lincoln's-inn-fields, impts. in the manufacture of wrought iron and steel, and in the apparatus to be employed therein,—a communication.
1116. William Walsh, of Manchester, impts. in obtaining and purifying oxalate of soda; which impts. are also applicable to the manufacture of oxalic acid.
1117. Robert George Kent, of Old Compton-street, Soho, impts. in the construction and arrangement of shades and reflectors for gas lights.
1118. Edwin Chesshire, of Birmingham, impts. in apparatus for intercepting the solid portions of the soil of water-closets.
1119. William Boothroyd, of Halifax, Yorkshire, impts. in stationary engines or apparatus for obtaining motive power.
1120. Richard Archibald Brooman, of Fleet-street, new fabric suitable for trimmings,—a communication.
1121. Frank Applegate, of Bradford-on-Avon, impts. in stopping and starting railway trains.
1122. Peter Bradshaw, of Earls Barton Mills, Northamptonshire, impts. in mounting or hanging mill stones for grinding grain and other substances.
1123. Joseph Henry Knott, of Nelson-square, Blackfriars-road, impts. in pumps.
1124. William Glover, of South Shields, impts. in means or apparatus to facilitate the steering of ships and other vessels.
1125. William Crane Wilkins, of Long Acre, impts. in lamps.
1126. Samuel Beach Cochran, of Fleming-road, Kennington, impts. in sewing machines, and in apparatus connected therewith.
- The above bear date May 5th.*
1127. Thomas Sagar and John Wilkinson, of Burnley, Lancashire, impts. in power looms for weaving.
1128. James Townsend Ward, of Swansea, impts. in carriages.
1129. William Edward Gedge, of Wellington-street, impd. toy,—a communication.
1130. Samuel Hibbert, John Lawton, and James Kay, of Manchester, impts. in apparatus for cleansing potatoes, and in decorticating the same and other esculent roots.
1131. Samuel Dunseith Mac-Kellen, of Manchester, impts. in watches and other time-keepers.
1132. Isaac Merritt Singer, of New York, impts. in sewing machines.
1133. George Davies, of Serle-street, impts. in machinery or apparatus for forging and dressing horse-shoe and other nails,—a communication.



1134. Thomas Beesley, of Symond's-inn, impts. in the construction of boxes or cases for carrying and packing bottles.
1135. Archibald Sturrock, of Doncaster, impts. in locomotive engines and tenders.
1136. Charles Wilkinson Atkinson, of Montague-place, Russell-square, impd. steam or other motive-power engine.
1137. Alfred Vincent Newton, of Chancery-lane, impts. in sewing machines,—a communication.

*The above bear date May 6th.*

1138. James Park, of Bury, impts. in communicating motion to machinery for manufacturing paper pulp.
1139. Jacob Snider, jun., of Dorset-street, impts. in breech-loading fire-arms and ordnance.
1140. Peter Bourne, of Whitehaven, impts. in miners' lamps.
1141. John Walker, of Cromptall-bridge, near Stockport, impts. in the construction of mechanism applicable to looms, and partly to carding engines and other machinery.
1142. Alfred Stanley, of Walsall, impts. in the mode of finishing clasps and other such like metallic connectors; and which said mode of finish is also applicable for other purposes.
1143. George Bower, of St. Neots, and Alexander Dick, of Alfred-street, City-road, impts. in the purification of gas ordinarily used in illuminating, and in the reduction of ores and smelting of metals by means of such gas so purified.
1144. Thomas Small, of Boston, impts. in motive-power machinery.
1145. John Bettridge, of Birmingham, impts. in the ornamentation of papier-maché or other japanned wares, wood, ivory, or other similar materials.
1147. Jean Baptiste Pierre Alfred Thierry, of Paris, impts. in the arrangement or construction of furnaces, to render the combustion of the fuel more complete, and to prevent the emission of smoke therefrom.
1148. Thomas Holliday, of Huddersfield, impd. blue coloring matter.

*The above bear date May 7th.*

1149. Peter Joel Livsey, of Manches-

- ter, impts. in compound steam engines,—a communication.
1150. Alexander Skwarcow, of Leadenhall-street, impts. in the construction of turn-tables,—a communication.
1152. John Smalley Grimshaw, of Huncoat, near Accrington, impts. in looms for weaving.
1153. Charles Lloyd Braithwaite and Joseph Hirst, of Kendal, impts. in machinery for feeding slivers of wool and other material to carding engines.
1155. Justus Charles Droop, of Schwelm, Prussia, an instrument or holder for holding nails, screws, or other fastenings.
1156. William Clark, of Chancery-lane, impts. in coating wrought or other iron, to protect it from corrosion or oxidation,—a communication.
1159. George Tomlinson Bousfield, of Loughborough-park, Brixton, impts. in steam engines,—a communication.

*The above bear date May 8th.*

1160. William Thomson, of Glasgow, impts. in obtaining motive power, which impts. are applicable in part for raising or forcing fluids into steam boilers, tanks, and other vessels.
1161. James Stickland, of Gee-street, St. Luke's, impts. in laying veneers on to surfaces, in applying the glue for that purpose, and in the apparatus employed.
1162. Samuel Wilson, of Manchester, impts. in hoops or bands for fastening bales, and in machinery or apparatus for making the same.
1164. James Norie, of Glasgow, impts. in making moulds for casting, and in apparatus therefor.
1165. Joseph Page and Alfred Thomas Wayne, of Birmingham, an impt. or impts. in the manufacture of pens.
1166. John Brierley, of Denby Dale, near Huddersfield, impts. in dyeing knickerbocker yarns, and textile fabrics manufactured of or from such yarns.
1167. William Boaler, of Manchester, an impd. dryer fabric for paper-making.
1168. Edward Rawson Clark, of Thistle-grove, Brompton, impt. in the construction of portable wine casks or

- bins for domestic use or export, and a pic-nic chest combined.
1169. Narcisse Legendre, of Saint Pierre-les-Calais, impts. in the construction of scissors.
1170. Richard Archibald Brooman, of Fleet-street, impts. in the manufacture of lamp-black,—a communication.
1171. John Bland Wood, of Broughton, near Manchester, impts. applicable to the defending of ships or vessels and forts when armour plating is employed.
1172. James Burrell, of Back Church-lane, Whitechapel, impts. in machinery for cutting the teeth of bevelled wheels.
1173. Charles Hanson Greville Williams, of Glasgow, impts. in the manufacture of coloring matters.
1174. James Burrell, of Back Church-lane, Whitechapel, impts. in salinometers.
1175. John Henry Johnson, of Lincoln's-inn-fields, impts. in rotatory engines,—a communication.
- The above bear date May 9th.*
1177. Benjamin Hargreaves, of Arden House, near Accrington, impts. in tiles for drainage or sanitary purposes.
1178. Robert Burgess, of Manchester, impts. in machinery or apparatus for marking, etching, or engraving cylindrical and other surfaces.
1179. Christopher Shorrocks and William Shorrocks, of Over Darwen, impts. in power looms for weaving.
1182. James Parkinson, of Tichbourne-street, new or impd. mode of manufacturing tablets, to be used for monumental purposes.
1183. Richard Archibald Brooman, of Fleet-street, impts. in coupling and disconnecting carriages on railways, and in machinery employed therein,—a communication.
- The above bear date May 11th.*

## New Patents Sealed.

- 1862.
3127. Joseph Townsend.
3133. Charles Wagner.
3137. C. A. Orth.
3139. Aaron Sutton.
3140. W. E. Gedge.
3141. W. E. Nethersole and C. Buckland.
3141. Charles Powell.
3155. William Tatham.
3159. A. L. Woolf.
3167. T. M. Elton.
3170. Joseph Steinthal.
3171. Francis Palling.
3174. J. R. Danks, B. P. Walker, and R. P. Walker.
3176. John Halford.
3179. Thomas Keyworth.
3180. W. T. Rowlett.
3181. D. Auld and D. Auld, jun.
3183. D. Veerkamp and C. F. A. Van Trigt.
3184. William Clark.
3189. J. H. Johnson.
3191. J. Cresswell and E. T. Greeves.
3192. S. J. Browning.
3193. William Clark.
3194. W. Buller and J. H. Mugford.
3196. J. Adams and W. C. White.
3197. Alexander Dudgeon.
3200. F. G. Taylor.
3206. J. C. Robertson and W. C. White.
3207. The Rev. H. Moule.
3211. Michael Henry.
3212. H. L. Emery.
3214. G. F. Griffin.
3215. Thomas Waller.
3217. Robert Flude.
3219. Joseph Romer.
3221. P. W. Reuter.
3223. Benjamin Oldfield.
3230. G. F. Blumberg.
3231. John Wheatley.
3232. Thomas Cook.
3236. A. P. Charles.
3243. C. F. Claus.
3252. James Braddock.
3256. John Robinson.
3258. Richard Wallis.
3260. F. G. Webb.
3262. L. Christoph, W. Hawksworth, and G. P. Harding.
3263. E. B. Wilson.
3267. W. J. Smith.
3270. H. A. Bonneville.
3272. J. and M. Craig.

3273. George Wright.  
 3274. William Mc Naught.  
 3279. R. E. Donovan.  
 3281. William Palliser.  
 3284. John Sellars.  
 3286. R. A. Brooman.  
 3287. G. A. Huddart.  
 3288. Charles Sanderson.  
 3290. John Hilliar.  
 3291. John Hilliar.  
 3292. E. T. Hughes.  
 3295. Thomas Wingate, jun.  
 3296. Victor Mirland.  
 3300. George Jeffries.  
 3303. Peter Effertz.  
 3304. W. E. Newton.  
 3306. John Lamb.  
 3307. William Inglis.  
 3310. L. B. Whitfield.  
 3312. A. P. Price.  
 3313. David Chalmers.  
 3315. William Clark.  
 3316. John King.  
 3317. Edward Toynbee.  
 3318. Isaac Spight.  
 3319. W. Tristram and H. Brereton.  
 3320. J. R. Breckon and T. Douglas.  
 3321. R. A. Ronald.  
 3322. Robert Clark.  
 3323. A. W. Burgess.  
 3324. John Imray.  
 3325. William Goulding.  
 3326. F. E. Vickers.  
 3329. J. E. Roussel.  
 3330. J. Gaskell and H. Walmsley.  
 3334. Samuel Fox.  
 3338. Ernest Thorold.  
 3339. Charles Corbet.  
 3344. Michael Henry.  
 3345. M. J. Roberts.  
 3348. George Buchanan.  
 3349. William Phelps.  
 3353. J. Mc Innes and E. F. Prentiss.  
 3354. J. Varley and J. Crowther.  
 3358. J. J. Lemon.  
 3359. W. and A. Smedley.  
 3363. R. Schomburg and A. Baldamas.  
 3364. Heinrich Jorns.  
 3365. Robert Hattersley.  
 3367. Augusto Albini.  
 3368. Coleman Defries.  
 3372. J. Ramsbottom and G. Hacking.  
 3373. J. W. Hadwen.  
 3374. T. C. Barraclough.  
 3376. Leonard Latter.  
 3383. Edmond Lepainteur.  
 3384. John Clayton.  
 3392. S. C. Lister.
3393. A. V. Newton.  
 3394. Isaac Holden.  
 3395. Isaac Holden.  
 3397. W. S. Longridge.  
 3401. Joseph Dalton.  
 3404. A. T. Blakely.  
 3415. G. E. M. Girard.  
 3419. J. B. Dalhoff.  
 3422. Frederick Parker.  
 3428. J. Whitley and J. W. Burton.  
 3429. Samuel Russell.  
 3432. G. H. Birkbeck.  
 3442. R. Laikin and J. Wain.  
 3446. J. H. Johnson.  
 3452. William Clark.  
 3453. C. F. Varley.  
 3461. J. H. Riddell.  
 3463. John Swainson, jun.  
 3469. W. Billingham and J. Requa.  
 3473. H. A. Bonneville.  
 3477. J. E. Carter.  
 3479. William Clark.
- 1863.
24. F. Sknll and E. Mealing.  
 81. W. H. Moreland and J. Chappell.  
 84. Michael Henry.  
 99. W. E. Newton.  
 110. C. E. Amos.  
 196. John Grant.  
 253. James Platt.  
 256. William Clark.  
 262. H. A. Bonneville.  
 306. T. L. Jacobs.  
 308. W. E. Newton.  
 412. John Morgan.  
 417. W. C. McEntee and G. and T. Withers.  
 458. Nathan Thompson.  
 501. George Davies.  
 517. F. A. Gatty.  
 521. William Readman.  
 576. George Haseltine.  
 638. G. T. Bousfield.  
 654. Sir A. Keller.  
 688. William Smith.  
 716. W. E. Newton.  
 717. Georges De Laire.  
 734. George Haseltine.  
 738. J. Saunders and J. Piper.  
 739. S. L. Crocker.  
 765. T. G. Grant.  
 770. George Davies.  
 798. William Blake.  
 880. J. Howard, E. T. Bousfield, and J. Pinney.  
 852. G. A. Cox.  
 1020. Robert Lavender.

•• For the full titles of these Patents, the reader is referred to the corresponding numbers in the List of Grants of Provisional Specifications.

# NEWTON'S

## London Journal of Arts and Sciences.

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No. CIV. (NEW SERIES), August 1st, 1863.

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### THE SEWING MACHINE TRADE.

If the history of sewing machinery is ever fully written, it will furnish many valuable illustrations of the operation of the patent laws; some of which will serve the cause advocated by the supporters of those laws; while others will provide the Sir W. Armstrong school of political economists with admirable examples of the obstructive nature of patents. At the present time a little drama is being enacted, which would form no unimportant episode in the history; and as it possesses some features of general interest, besides affecting the vital interests of the sewing machine trade, we propose to sketch its progress, for the benefit of our readers, supplementing first an introduction, and then, as we proceed, undertaking the ancient office of Chorus to the drama, in order that, by the aid of a running commentary, the plot may be the better understood.

It will be remembered, that the sewing machine, which is already in general use in every civilized country, originated with Mr. Elias Howe, who, in the year 1846, sent a small working machine from the United States to this country, and sold the invention to Mr. Thomas, of Cheapside. Between that time and the present, numberless attempts have been made, both in America and Europe, to engraft improvements upon the original invention. In America, the chief improvements were, after some costly litigation, thrown together, so as to make one common property; and, under this arrangement, both the manufacturers and the public have greatly benefitted. In England, however, the case was different. Mr. Thomas, having secured the invention, so far as it was carried by Mr. Howe, under an English patent, dated December 1st, 1846, allowed it to slumber, until public interest was excited in the invention, by the introduction of a variety of machines into this country from the United States between the years 1849 and 1852. This appears to have awakened Mr. Thomas to a sense of the value of the rights he had purchased and secured under his patent of 1846; and availing himself of the experience of the past, and embodying some improvements secured under a patent of 1853, he produced the machine which has for many years successfully competed with all

others in the market. But when he had thus proved the commercial value of the patent of 1846, he bethought him also of its legal value, and being advised that the machine described in his specification (which was a needle and shuttle machine) possessed certain features essential to all good sewing machines, and to be found in those now largely in demand, he considered it prudent to assert his rights. The house of Grover and Baker, of Boston, U.S.A., who are large manufacturers and importers into this country, was the first selected to proceed against. A trial took place in 1857, and resulted in a verdict for the plaintiff. Shortly after a second trial was directed against Mr. Foxwell, a manufacturer at Manchester, and again a verdict was obtained by the plaintiff. An objection, however, was taken to the validity of the patent, on the ground of a defect sought to be remedied by a disclaimer entered in 1855, being still untouched by that document; and it was eventually decided that this objection was tenable. The verdict was therefore set aside by the Judges of the Court of Queen's Bench, in 1858.

It is not unreasonable to suppose that the hostile feeling engendered by this course of litigation between Mr. Thomas and Mr. Foxwell gave zest to the proceedings on which the little drama above alluded to is based, if it did not originate those proceedings. Before raising the curtain, and introducing the actors on the stage, we must carry our auditors back in imagination to the autumn of 1852, at which time two ingenious American gentlemen, availing themselves of the English patent law for encouraging inventors, were busily engaged, aided by a Manchester patent agent, in securing to themselves a collection of inventions with which, in their travels, they had made acquaintance, and now wished to bring under the notice of the British public. By a patent granted to Mr. E. J. Hughes, dated August 10th, 1852, protection was given to improvements in mules, in looms, and to three arrangements of sewing machines. Who were the inventors of the improvements in mules and looms, we care not to enquire, but the three sewing machines appear to have been patented in anticipation of, and antagonistically to, the several inventors; for one, having a vertical and a circular horizontal needle, with a four-motion feed, was patented some six weeks after, in ignorance of the nature of Hughes's application, on behalf of Messrs. Grover & Baker, the original inventors. Another, having two straight needles, working at an angle to each other, was patented some five weeks after, on behalf of Mr. Otis Avery; while the third appears to be due to several inventors, but mainly to Mr. Singer, some of whose American claims are inserted *verbatim* in Hughes's specification: *this machine is not, however, otherwise patented in its totality in*

this country. The chief mover in this business was Mr. C. T. Judkins, who, two months after the patent of Hughes, took out a second patent for a sewing machine, in which the four-motion feed of Grover & Baker was introduced, for the first time, into a shuttle machine. Some credit is due to Mr. Judkins for the manner in which he pushed the sewing machine into notice; but whether it was that he could not command capital enough to enable him to profit by the conquered prejudices of the public against sewing machines, or from other causes, certain it is that he served only as a pioneer to others who followed in the path he had beaten for them. In the meanwhile, the mechanism, which we have called the four-motion feed, became extensively adopted, both in double-needle and in needle-and-shuttle machines, and Judkins's patent, which had been thought little of, dropped out of sight. It had, however, its merits; and Mr. Foxwell was the happy individual to appreciate them. In the year 1859, he bought the patent of the assignees of Mr. Judkins for £50, and it was not long before he put it to use. Thus much, then, for our introduction, and now begins the drama.

Act I. opens with a scene at the Liverpool Assizes, the time represented being the spring of 1860. William Thomas is cited to show cause why judgment shall not be pronounced against him, for that he has appropriated to himself certain ideal properties, of which one Daniel Foxwell is the rightful owner, under a grant of Her Majesty's, bearing date the 16th October, 1852. The defendant denies the alleged appropriation, and also denies that the plaintiff has any right to the alleged ideal properties, they being vested, if anywhere, in the person of one E. J. Hughes, a prior grantee of the Crown; and thereupon he appeals to a jury of his countrymen. The Court explains:—"The real great struggle is—whether, after Hughes's patent was published to the world, this [invention of plaintiff's] is novel," and the jury, without giving much heed to this comparatively abstruse point, after hearing the plaintiff's evidence, decide that "the defendant's arrangement is substantially different," to which the Court adds, to complete the sentence, "so as not to constitute it an infringement." Thus terminates, without the defendant's evidence being called, Act I. of the drama.

It is now the part of Chorus to explain that the partial trial of this case has brought into relief certain defects in the patent which, had the plaintiff gained a verdict, would have effectually prevented him from retaining it. Behold him, therefore, under good advice, expunging from his specification, by a disclaimer, dated March, 1862, all claims of details, and also amending a very defective description. Having thus furnished up his weapons of offence, he proceeds to renew the attack.

In the first Act, the interest centred on the proof that the defendant Thomas used the same working instruments—that is, a vertical needle for piercing the fabric to be sewn, a shuttle for catching up and securing the loops made by the needle, and a four-motion feed, for pushing forward the work under the needle; which working instruments were actuated by one central motion, that is, a driving shaft carrying cams, for operating the several instruments. The jury, having admitted that the defendant did this, by finding a substantial difference in the arrangements of the litigants, to some extent disposed of the cam motion question; and the interest next concentrates in the use of the four-motion feed in a shuttle machine.

Act II. opens with a scene in the Court of Common Pleas, at Westminster Hall; the time occupied being six days of the month of February, 1863. Evidence is called on the one side to show how clever and important was the adaptation of the four-motion feed to shuttle machines; and, on the other side, to prove both its want of novelty and the groundlessness of the assumption that the introduction of that feed was any invention at all. So keen, indeed, is the contest on this point, that the defendant's counsel omit to instruct the Court as to the fact that the wheel feed was used indifferently, and with good effect, in the two kinds of machines, and therefore, by analogy, another feed might be similarly applied; and further, that a double-needle machine is a really useful machine. Indeed, so fogged is the learned judge on these points, and convinced of the utter inutility of the wheel feed, that in charging the jury, he says, "I should think it quite clear that the American who invented the machine No. 2 [Singer's shuttle machine in Hughes's specification], with the roughened cylinder [wheel feed], would have been very glad if it had pleased the Author of our ideas to suggest to him the four-motion feed instead of the cylinder." And again, in explanation of the fact, which might appear singular to an ordinary observer, that Messrs. Grover & Baker did not themselves adapt the four-motion feed to a shuttle machine, instead of applying it to a two-needle arrangement, which the learned judge was led to believe was a comparatively useless sewing machine, he says, "Nothing can be more remarkable in the obtaining of the secrets which the bounty of Nature has diffused over this world, than the close approximation, up to the desired point, that it is the will of Providence men should be constantly making,—almost passing over exactly the desired point; then standing a little backward, and the desired point is missed." By these philosophical remarks the jury is left to infer that Providence had singled out Mr. Judkins

"To do the happy deed which gilds *his* humble name."

Yet, notwithstanding, they can come to no agreement; and with their discharge, without giving a verdict, ends Act the Second.

"Many things," says Sophocles' Chorus, in the ancient play of Antigone, "are wily, and nothing more wily than man. Finding a way through every thing, he comes to nothing that is to be without resource." So Foxwell, after a defeat at Liverpool, and only a repulse at Westminster, finds his present position so encouraging by contrast with the former, that he must needs blaze it to the world as almost a triumph. Now comes his man of law forward, to gather in, by a skilful hand, the harvest which a copious outlay should have already ripened. And how does he proceed to reimburse his client for the capital invested in the purchase of the patent, the rectification of the specification, and the prosecution of two actions at law? The following proclamation will explain:—

4 Tokenhouse Yard,

April, 1863.

I am instructed by Mr. D. Foxwell, of Manchester, the proprietor of letters patent granted to Mr. C. T. Judkins, 16th October, 1852, for improvements in sewing machines, to apply to you for payment of royalties on all machines which have been made, sold, or used by you, having a needle and shuttle, according to the principle of the said patent right. • • • Mr. D. Foxwell was advised by most eminent counsel, engineers, and patent agents, that the machine which Mr. W. F. Thomas patented (27th April, 1853,) was an infringement of Judkins' patent above referred to, and accordingly brought an action against Mr. W. F. Thomas, to recover damages against him for having infringed Judkins' patent. • • • The trial commenced before the Lord Chief Justice of the Court of Common Pleas and a special jury, at Westminster Hall, on Friday morning, the 6th February last, and continued until the following Thursday evening, six days, when the jury were discharged. • • • Mr. Thomas has amassed a large fortune by the sale of needle and shuttle sewing machines, which, Mr. Foxwell is positively advised, are infringements of his patent right; and all persons who have used any such machines, or made or sold them, are liable to Mr. Foxwell for royalties thereon. • • • As I am informed you have used a large number of Thomas's sewing machines, which are an infringement of Mr. Foxwell's patent rights, I hereby, as his solicitor, and on his behalf, require you to make to me a return of the number of all such machines within seven days from the date hereof; and I inform you that Mr. Foxwell will require you to pay to me the sum of five pounds, as a royalty, on every such machine. • • • It must, however, be distinctly understood, that if the five pounds royalty, per machine, be not paid, and he has to bring an action and take proceedings against you for infringement, he will reserve to himself the right to claim *full* damages and costs. In order that you may be thoroughly satisfied of the legal rights of Mr. Foxwell, I send you, by book post, a printed copy of the short-hand notes of the summing up of the Lord Chief Justice on the late trial. • • • If I do not hear from you satisfactorily within the time mentioned, I shall bring an action against you, at the suit of Mr. Foxwell, for the recovery of *full* damages and costs; but I trust you will see the propriety of avoiding the enormous costs of another trial, which, I think you will see, could only terminate to your discomfort and loss.

H. WICKENS.

Can it be that no kindly response follows this generous warning of threatening danger? We fear it is so; but let us not anticipate the action of the play.



Act III. opens with a renewed attempt on Mr. Foxwell's part, in June of this year, to substantiate his claim to the exclusive use of the four-motion feed in shuttle machines. Again, is Thomas cited to show cause why all machines made and sold by him since the date of Foxwell's disclaimer (March 10th, 1862), or to be sold between the present time and October, 1866 (which machines must be counted by thousands), should not pay the royalties demanded. The relative strength of the combatants, by reason of the several contests, is now well known to either side; and the struggle now surging this way, now the other, is maintained with a tenacity worthy of a righteous cause. For a moment they stop to breathe, and a soft voice whispers, Why do ye strive! Are ye not brethren? but the words are disregarded. Again the contest rages, and after a while another pause ensues, when a soft voice is heard to whisper, If this patent fall, shall not the whole trade enjoy it? Upon this a parley is sounded, terms are arranged, and the court and jury are congratulated on the happy termination of Act III. of this exciting drama.

Oh! for the pen of the proverbial philosopher, Tupper, to point the moral of these passing scenes! Verily, if success attend some men, Folly will certainly overtake them. And Folly is a siren that has marred many a man's happiness. If escape from a defeat was, as has been shown, so encouraging as to produce the Wickens proclamation, what proceedings might one not expect when Thomas found it to his interest to withdraw from the contest. The Third Act has just closed, and now harken to the flourish of trumpets re-echoing from Tokenhouse Yard. It announces a second proclamation. What says the herald?

"Mr. D. Foxwell, of Manchester, having obtained a final verdict against Mr. W. F. Thomas, for infringement, establishing the validity of Judkins' patent of 16th October, 1852, for sewing machines, of which he is the proprietor, I am instructed by him to require the *immediate* payment to me of royalties on all machines having a needle and shuttle, which have been made, used, or sold, in infringement of that patent (excepting those which have been or may be sold by Mr. W. F. Thomas, for which he has paid Mr. Foxwell); and as you have made, used, or sold, a number of sewing machines, made by different persons, which infringe that patent, I require you, within three days, to make a true and correct return to me, stating the number of all such machines, that I may know the total amount of royalties, at the rate of five pounds per machine, payable by you. \* \* \* I rely on the required return within the time limited, or I shall take proceedings against you, and file interrogatories for your examination, *on oath*, of all machines you have made, used, or sold; and obtain an order for the inspection of your premises and books, and papers, with reference to the machines."

Is this a wanton challenge to the trade; or has the man no mercy? Listen, he speaks again—

"The suggestion that persons who have purchased the machines have already paid the full value for them, and that it is therefore hard they should have to pay a further sum on each machine is inconsistent; because the amount of royalty ought to have been added to the price when they purchased them; and, as they did not pay it then, it is only right they should do so now."

Alas for these innocent sinners, for evil days have fallen upon them, and who is there to deliver them? Hath not Foxwell obtained at last a verdict by consent, and that against Thomas, whose machines are very different from most of theirs! But then they are infringements, because Foxwell has obtained a verdict by consent. Can the Courts of Equity resist this reasoning? Doubtless they cannot; for the cautious man of law has said, "I shall file interrogatories for your examination on oath, and obtain an order for inspection." Neither must they think to escape who use no four-motion feed, for that prevailing error is mercifully corrected by a revised edition of the second proclamation, which now runs, "I am instructed to require the immediate payment to me of royalties on all machines having a needle and shuttle, *or any of the principal movements secured by that patent*, which have been made in infringement of that patent." What the principal movements secured by the patent are, you must not pretend ignorance of, for does not the specification show them? Moreover, there is the oracle of Tokenhouse-yard, who will inform you. Hark! it speaks:—

"Howe's improved machines clearly infringe Judkins' patent, and unless you make the return I have required, at once, I shall issue process against you, and compel it, and payment of full damages and costs."

Bend, therefore, O ye sewing machine makers, vendors, and users, to your fate! Would ye tempt the anger of the gods, or their representative, Wickens? He is, indeed, merciful. Only harken to his gentle pleadings—

"I much regret, on your account, that you have not made the return of all the sewing machines having a needle or shuttle, or any of the principal movements secured by letters patent to C. T. Judkins, on 16th October, 1852, of which Mr. D. Foxwell is the proprietor, which you have made, used, or sold in infringement of the patent, because I have now no alternative but to sue you for recovery of full damages and costs; and I request the name of your solicitor, who will accept service of process, to prevent the necessity of service in the usual way. But I yet hope, that as the patent has been established at law, you will not involve yourself in useless and ruinous costs. No such machine must be used or disposed of in future, unless there be a license plate thereon, which will be supplied by me for Mr. Foxwell on payment of £2 per plate, and carriage, if any."

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We have now traced this interesting drama, with its interludes, so far as it has been enacted, and must wait in patience for its further development; but, in the meanwhile, it will not be unprofitable in sober earnestness to enquire in what position the trade is placed by this unexpected claim of Mr. Foxwell. It is no exaggeration to say, that the trade is deluged with lithographed letters, bearing the imprint of "H. Wickens," threatening, as we have seen, all kinds of dreadful things to those who will not succumb. These are not only sent to machine makers who, from their familiarity with patents, would know how to treat such

letters, but also to the sellers and users of sewing machines, who can know little or nothing about their legal value. The effect has been, as we are assured, to paralyze the operations of the dealers, who now feel safe only when purchasing the Thomas machines. While therefore, the representatives of the large American houses are seeking powers from home to guarantee purchasers of their machines against the threats of Foxwell, and the English manufacturers are waiting to see the development of Act IV. in the drama, an open road is provided for Mr. Thomas, who, if he has paid, as is alleged, for a license from Foxwell, will quickly recoup himself.

In respect of the legal status of Mr. Foxwell, we have not space now to enter fully; but it may be satisfactory to the trade to know, that notwithstanding Mr. Wickens's assertion that he is acting under the advice of the "most eminent counsel, engineers, and patent agents," we have come to the opinion, after a very careful consideration of the subject, that Mr. Foxwell's pretensions are perfectly untenable; and in this we are confirmed by the evidence of the scientific gentlemen (no mean authorities) engaged on Mr. Thomas's defence. Neither, be it remembered, has there been any verdict of a jury (which if given in favour of Foxwell, could not, in our opinion, be maintained) adverse to our view of the question. After ten years of uninterrupted possession, the trade will not certainly yield to threats; and indeed already is there evidence of this, in the movement of the sewing-machine makers of Manchester, who are organizing their forces to try the merits of the case. Mr. Foxwell is evidently bent on illustrating the old proverb,

*"Nil mortalibus arduum est,"*

and no wonder; for the prize he is trying for is a large one. If we take the number of machines annually sold in Great Britain, that come within his own interpretation of his claims, at the modest estimate of ten thousand, this would yield him, at £2 per machine, an annual royalty of £20,000,—a tolerable return for an outlay of £50! but added to this, are the many thousand machines already in use, on which the royalty of £5 per machine is demanded.

We sincerely regret that this case was not earlier developed, to enable it to be included in the evidence taken by the Royal Commission on Patents; for it admirably illustrates the necessity for the appointment of an officer to examine all complaints of infringement, and to withhold from the applicant, when his complaint is considered groundless, authority to pursue his claims at law. We trust, however, that the forthcoming reform in patent adjudication will contain a provision of this nature.

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### Recent Patents.

To WILLIAM EDWARD NEWTON, of 66 Chancery-lane, for improvements in the mode of, and apparatus for, treating fermentable substances for brewing and distilling,—being a communication.—[Dated 23rd August, 1862.]

ACCORDING to this invention, the grain, malt, potatoes, or other substance to be operated upon is soaked for several hours in water, and afterwards crushed, squeezed, or pressed into a pulpy mass, which is then placed in a vessel, and hot water or steam is added until the temperature is raised considerably; or the mass may be heated by steam pipes until it is converted into a kind of paste. The mass is then passed into a straining apparatus, in which the husks, grains, and unfermentable parts are removed. This removal of the husks and unfermentable particles greatly facilitates the subsequent processes of distilling and brewing, as it economizes heat and prevents the mass from burning. The pulpy mass is then conveyed to a heating apparatus, and the temperature is raised to about 63° of Reaumur, at which temperature sugar begins to form. Here it remains for a certain time, and it is then cooled by passing cold water through it, after which it is passed into the fermenting tubs. This is the process to be followed for distilling.

For brewing, the pasty mass, when cleared of the husks, is to be boiled for the requisite time with a suitable quantity of water, and then cooled.

The apparatus whereby the pulpy or pasty mass or liquid is heated and cooled consists of two vessels, placed one within the other, leaving a vacant space all round between them for the admission and circulation of either hot or cold water. The inner vessel is provided with a number of hollow partitions, which communicate with the surrounding space, so that by filling this space with hot or cold water, as the case may be, the contents of the inner vessel may be modified in temperature, that is,—either heated or cooled, as may be required. The space between the two vessels may also be subdivided by means of vertical partitions, so as to ensure a perfect circulation of the water. Two supply pipes, one for hot water and the other for cold, communicate with this space; and an exit pipe, for drawing off the water, is also provided. In order to assist the circulation of the water and keep the temperature uniform throughout the mass of water, horizontal axles or shafts, provided with stirrers or radial arms, are mounted in the sides of the outer vessel, and the radial arms are made to enter between the hollow partitions, and agitate the water.

The straining apparatus, for removing the husks and unfermentable parts from the pulpy mass, consists of a rectangular vessel, in which are mounted two, three, or more pairs of pressing rollers, and also a series of carrying rollers, over which passes an endless travelling apron made of wire gauze. The goods, or mashed grain or malt, mixed with water, are placed in a hopper, in which is a stirring shaft, whereby the mass is kept well mixed. The semi-liquid mass is allowed to flow out of the hopper on to the travelling endless gauze, and will be carried along thereby under pressing rollers, which will squeeze out the moisture contained in the grains, and allow the husks to be carried forward by the travelling gauze, and discharged at the other end of the machine. The liquid parts will, of course, pass through the wire gauze, and fall into a vessel or suitable receptacle placed below.

In Plate III., fig. 1 is a plan view of the improved cooling and heating apparatus; and fig. 2 is a longitudinal vertical section, taken in the line c, d, of fig. 1.

The construction of the apparatus is as follows:—J, is a copper reservoir, in which a second vessel K, of similar form, is placed. The space left between the vessels J, and K, may be kept constantly filled, either by the tube L, with warm, or by the tube L', with cold, water; and, in both cases, the water can be let off by the pipe M, which is provided with a suitable stop cock. The cold or warm water runs not only through the above-mentioned space but also through the partitions N, in the vessel K. These partitions N, are brought into communication at their lower part with the reservoir J, by means of the conical valves d, and at their upper part with each other, and with the water reservoir, by the conical valves b. The circulation of the water, necessary for the present purpose, through the apparatus, is chiefly effected by the water space being divided into three water-tight separate compartments, by means of the strengthening pieces c. Through the vessels J, and K, three horizontal axes f, are mounted in suitable bearings in the vessel K, and each of these axes is provided with stirring arms m, which work between the partitions N. The axes f, are driven by bands, passed round the pulleys R. In using the apparatus, the cold or warm water is kept a little higher in the reservoir J, than in the tubes P, which may easily be done by properly regulating the stop cocks at L and L', as well as at M. The height of the liquid mash or wort in the reservoir K, is shown in fig. 2.

The husking apparatus is shown in longitudinal section at fig. 3. Its construction is as follows:—Between two frames A, and A', suitably connected together, there are placed, in bearings, three heavy cast-iron rollers B, B', B'', so mounted that they may be raised in their bearings. The simultaneous rotation of these rollers in one direction, as indicated by the arrows, is effected by straps and pulleys. The rollers B, B', and B'', communicate their motion to the hollow rollers D, D', D'', beneath them, by means of cog wheels. Between the pairs of rollers B, D, B', D', and B'', D'', an endless band of brass gauze c, is made to pass, and is driven by the rotation of the rollers. The tension of this band is maintained by four rollers d, d, d, d, made of gutta-percha, the bearings of which are made adjustable. The gauze band c, is further supported by rollers n, made of gutta-percha, the bearings of which rollers are fitted in the frame. E, represents a mill hopper, in which the mass of malt or grain, properly prepared, is placed, and is worked through an opening v, by the arms of the rotating shaft f. From this hopper E, the mass falls through an adjustable opening v, on to the travelling gauze c; a piece of leather v', or other suitable substance, being adapted to the opening v, for the purpose of forcing the mass to take a certain direction. F, is a trough, provided with an opening r, into which the husks, grains, or pressed-out mass falls, after having left the gauze, and is conveyed away through the opening r, to another vessel.

The patentee claims, "First,—the mode set forth of treating fermentable substances in the processes of brewing and distilling. And, Second,—the novel construction and arrangement of apparatus described, whereby the useful extract for brewing and distilling is obtained from the fermentable substances."

To DAVID AULD and DAVID AULD, jun., both of Glasgow, for improvements in working furnaces and steam boilers, and in apparatus connected therewith.—[Dated 27th November, 1862.]

THIS invention relates to the arrangement and construction of apparatus for regulating the supply of air to the furnaces of steam boilers; also, to self-acting apparatus for supplying water to the boiler.

The self-acting apparatus, for supplying air to the furnace, consists of a sliding panel, arranged at the front of the furnace door, the back part of which is formed with openings similar to the arrangement of a Venetian blind. The sliding panel is connected by a chain, which is carried up over a pulley, arranged on the upper part of the boiler, and is attached to a bell crank lever, by which it is connected to one of Auld's self-acting dampers; or, in lieu of the arrangement of a sliding panel, a throttle or other suitable valve may be used, where such modification is found more convenient.

When the pressure of the steam falls, the damper apparatus is brought into operation, and this being in connection with the sliding panel or other valve, it is thereby raised, so as to allow a larger supply of air to pass through the fuel, and thus increase the rate of combustion as well as the generation of the steam. On the other hand, if the steam is generated too rapidly, the self-acting apparatus causes the damper and sliding panel, or its equivalent arrangement, to be lowered, and so check the combustion of the fuel. This air-regulating apparatus may be readily adapted to, and connected with, any suitable self-acting damper apparatus; the connection being so arranged as to suit the particular kind of apparatus employed. Or, in lieu of this combination, the sliding panel may be arranged so as to operate in conjunction with a loaded disc, or piston, or a "reducing valve," or other self-acting valvular apparatus, by means of which the steam is kept at a uniform or nearly uniform pressure. This apparatus, or a modification of the same, is also applicable for the regulation of the air draught in the furnace and flues of the boiler. For this purpose, the apparatus hereinbefore described is connected, in any suitable manner, with a "gridiron" or other valve situated in the ash-pit of the furnace or other conveniently available position, so that the amount of draught admitted will always be in exact accordance with the requirements of the boiler.

The improved apparatus, for supplying boilers with water by self-acting means, is shown in elevation in Plate IV.; part of the apparatus being in section. A pipe *a*, leads from the water tank or other water supply source. This pipe is fitted with a valve chamber *b*, containing a valve which, when open, admits the water to a cylindrical water chamber *c*. This cylinder is fitted with a close cover, in which is a small valve *d*, opening inwards, and so arranged as to allow of the escape of air from the cylinder *c*. In the cylinder cover is fitted the bent steam pipe *e*, which branches off laterally, and enters the chamber *f*. This chamber is provided with a close cover, and in the lower part is a vertical branch, in which is a valve-seating to receive the valve *g*. This valve is connected to the lever and counterweight *h*, by which the valve and its connected parts are properly balanced. The vertical branch of the chamber *f*, opens into the pipe *i*, down which is carried the spindle *j*, that serves to connect the valve *g*, with an elastic diaphragm *k*, arranged within the

chamber *l*. This chamber is in communication with the pipe *m*, which extends upwards, and is carried by a lateral branch into the cylinder *c*, where it terminates near the bottom, as shown by the dotted lines. At the lower part of the stand pipe *m*, is a lateral branch, which opens into the valve chamber *n*; and branching off from this chamber is the pipe *o*, which extends downwards into the boiler *p*. A smaller pipe *q*, is arranged so that its open end terminates at the proper level of the water within the boiler; outside the boiler this pipe extends upwards, and enters the chamber *f*.

When the apparatus is in operation, the whole is filled with water, which flows from the tank or other source of supply into the cylinder *c*, and pipe *m*; water is also forced up the pipe *q*, from the boiler, and fills the chamber *f*, and the pipes *e*, and *i*; the valve *g*, being kept open by the pressure of the column of water in the pipe *m*, acting on the under side of the diaphragm *k*. As long as the lower end of the pipe *q*, is below the surface of the water in the boiler, the apparatus will remain in this state of equilibrium; but when the water in the boiler sinks below the mouth of the pipe *q*, which is the predetermined level, the steam rushes up the pipe, passes into the valve chamber *f*, and by the pipe *e*, into the cylinder *c*, where its pressure forces the water contained therein down the pipe *m*, and by the branch pipe *o*, into the boiler *p*. During this action, the valve in the box *b*, as well as the air valves *d*, and *r*, are closed by the pressure of the steam acting upon their surfaces; the pressure on the water also serves to open the valve in the chamber *n*, and thus admit of the water passing into the boiler by the pipe *o*. The self-acting valve *r*, is fitted to the upper part of the pipe *m*, to allow of the escape of any air that may collect therein.

Another mode of arranging this apparatus, where the position of the boiler does not admit of having the pipe *m*, extending up so high, consists in arranging, at a convenient part of the pipe *m*, a cylinder, connected with the water supply. In this cylinder is fitted a float, which is connected by means of a rod passing down the pipe to a lever, which is centred to one side of the box or chamber in which the elastic diaphragm *k*, is arranged; the lever being connected by a link to the diaphragm or its equivalent arrangement.

The arrangement to be adopted for the admission of the steam to the upper valve chamber and the cylinder, is similar to that before described. As the cylinder is filled with water, the float gradually raises the lever connected to the diaphragm or other arrangement, which, being lifted, also raises the upper valve; so that when the steam passes through the pipe *q*, and acts on the surface of the water in the cylinder, it is immediately forced into the boiler through the feed pipe *o*. The descent of the float causes the upper valve to close and shut off the egress of the steam into the cylinder, which is again filled by the water passing into it from the tank or other reservoir in readiness to afford another supply to the boiler when required. In this way, a constant and regular supply of water to the boiler is maintained, without requiring any personal attention on the part of those in charge.

The patentees claim, "First,—the arrangement, construction, and combination of parts forming the self-acting apparatus, for regulating the supply of air to the furnaces and flues of steam boilers, as described, or any mere modification of the said arrangements. Second,—the arrangement,

construction, and combination of parts forming the self-acting apparatus for affording a regular supply of water to boilers, as described, or any mere modification of the said arrangements."

*To JAMES BRADDOCK, of Droylesden, Lancashire, for certain improvements in machinery or apparatus for effecting the separation of impurities from the water employed in steam boilers, and also for effecting the circulation of the said water.*—[Dated 4th December, 1862.]

THIS invention relates to the cleansing of water employed in steam boilers, and in separating the floating particles, impurities, or extraneous matters therefrom, by allowing the impure matter to deposit in the form of sediment without being disturbed by the motion caused by ebullition. The improvement consists in the application of the steam in the boiler to raise the water from the bottom of the boiler to a chamber situated above the water line.

The machinery for effecting this object consists in an archimedean screw, against which the steam, in its passage to the dome of the boiler, acts in such a manner as to cause its revolution. This imparts a rotary motion to a second and increased length of screw, enclosed in a cylinder which communicates with pipes at or near the bottom of the boiler. Thus the revolution of the screw causes the water to be raised from the bottom of the boiler into the cylinder, whence it passes into an undisturbed chamber, where its impurities are deposited, and from whence it overflows into the boiler, whereby an improvement in the circulation of the water is effected. The patentee remarks, that this may be applied to the deposition of salt in sea water, and also that in boilers where "domes" are not used, an arrangement may be made to create a current of steam.

The figure in Plate III. is a longitudinal sectional view of a boiler, showing the apparatus for cleansing and circulating the water. *a, a*, is the boiler, and *b, b*, the main and branch pipes or tubes, extending along the lowest interior surface, their openings to receive the water and sediment being nearly close to the bottom. The pipe *c*, extends upwards, to supply the tank or cistern *d*, with the water and sediment; the upper portion of such pipe terminating in a cylinder *e*, (shown in section), within which an archimedean screw *f*, is caused to revolve by the vane *g*, on the screw shaft; the steam rising rapidly into the dome through the aperture beneath (over which the vane is situated) acting upon the blades of the vane and producing the lifting power. The scum on the surface of the water passes over the edge of the tank by ebullition, and there is retained, the plate or guard *i*, preventing any disturbance of the water in the tank. It will be seen that, by the means described, the water and sediment is raised from the lowest parts of the boiler, and discharged into the tank, where it is free from the motion caused by ebullition, and in which the heavier and impure particles subside to the bottom, allowing the water to overflow the cistern and return to the boiler in a cleansed state. When the tank has become filled, or partially so, with the dirt and sediment, a tap is turned, and the pressure of steam within the boiler causes its discharge through the pipe *k*.

The patentee claims, "the novel employment and use of the tank or



receptacle within the boiler wherein the sediment may be deposited, and the general combination of the whole to effect the cleansing and circulation of the water in steam boilers, as described."

To WILLIAM COLBORNE CAMBRIDGE, of Bristol, for improved apparatus for washing clothes, applicable also as a churn.—[Dated 1st October, 1862.]

THE chief object of this invention is to simplify the construction of apparatus for washing clothes, and to expedite that operation.

In Plate IV., fig. 1 shows the improved machine in longitudinal section, and fig. 2 is a transverse section of the same. The peculiar construction of this machine ensures that the saponaceous solution or liquid placed therein will, when put into violent agitation, be thrown upwards, and then deflected downwards, so as to impinge upon the clothes under operation. The washing machine may be described as consisting, in its simplest form, of a wooden box or chamber *a*, with a central opening at top to receive the clothes or other articles to be washed and the saponaceous liquid. The sides of the box are vertical, and their lower edges are carried down below the bottom of the box to form rockers *b, b*, which serve to support the machine. The ends are slightly inclined outwards towards the top, and the top of the box is closed with fixed dash boards *c, c*, and a removable lid or cover *c\**. The bottom of the box is slightly inclined upwards towards the ends of the box, as at *d, d*, and in the centre a segmental projection or bridge *e*, is formed, whereby the turning over of the clothes during the rocking action is greatly facilitated. The ends, bottom, and top of the box are clothed with corrugated zinc *f, f*, or other non-oxidizable metal lining; the metal lining being arranged so that the corrugations will lie transversely to the rockers. This lining, while presenting to the clothes a surface that can in no respect injure them, which pegs and such like projections are very liable to do, will ensure their rolling over as the machine is rocked; and thus every portion of the clothes will be presented in turn to the action of the saponaceous liquid. An advantage incidental to the use of the metallic lining as described, is that, by making it somewhat broader than the intended internal breadth of the box or chamber *a*, (as shown at fig. 2) and applying it previously to fixing on the side pieces, the edges of the metal may be pressed into the wooden sides, and water-tight joints thereby ensured. The ends of the sheet zinc or other metal are secured by means of two overlying bevilled bars of wood *g, g*, set transversely of the machine and fixed to the edges of the dash boards, of which they form a part. These bars serve to deflect the liquor, and also the clothes thrown up against the dash boards on to the bridge below, and thereby, through a kind of rinsing action, to wash out the dirt which has been disturbed by the rubbing of the clothes against the ribbed surface of the box. The opening in the top of the box is to be closed by the cover *c\**, during the rocking of the machine, which motion is readily effected by the attendant by alternately raising and depressing a handle *h*, carried by arms attached to the sides of the box.

When applying the invention for churning, it will only be necessary to reduce the size of the box; and if thought desirable, the machine

may be supported on trunnions in a separate frame, instead of standing on rockers. The construction will, however, be the same in all material points, as above described.

The patentee claims, "constructing washing machines and churns with an internal ribbed or corrugated metal surface, in the manner above described."

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*To CHARLES SANDERSON, of Sheffield, for an improved mode of manufacturing bands for driving machinery, lifting weights, and other analogous purposes.*—[Dated 8th December, 1862.]

THIS invention consists in making driving bands of thin sheet steel or other metal cut to the width of the intended band, and coated, in a peculiar manner, by India-rubber, so as to preserve the metal from oxidation.

The sheet steel or other metal, cut to the proper width and length, is first well cleaned by acids, to remove any oxide therefrom; it is then coated, by the electro-plating process, with brass; after which the metal band is covered with, and entirely enclosed by, a sheet of India-rubber, which is vulcanized thereon; when it will be found that the rubber will have such an affinity for the brass covering that it will adhere firmly thereto, and cannot easily be detached. Bands, of great strength, such as are required for lifting heavy weights in coal mines, may be made by combining together two, three, or more thin bands or strips of steel or other metal, coated and covered in the manner above set forth; interposing between the metal surfaces a layer of vulcanized India-rubber. The India-rubber covering will not only protect the metal from oxidation, but will materially assist in causing the band to hold tight on the driving or lifting pulleys.

In manufacturing bands of great length, strips of steel or other metal may be combined and rivetted, or otherwise connected together in such a manner as to break joint, and produce a band of equal strength throughout.

In Plate IV., fig. 1 is a plan view of part of a long band, formed of two thicknesses of sheet steel, with a layer of rubber between them, and showing also the mode of connecting the steel strips together, so as to form a strong band. It will, however, be understood, that more than two thicknesses of steel or other metal may be employed if desired. The band is composed of two thicknesses of sheet metal *a*; a part of the outer coating of India-rubber having been removed to show the metal bands within. The ends of the upper sheets of metal *a*, are brought together, and then rivetted to the under sheet; a layer of rubber having been previously placed between them.

Fig. 2 represents a sectional view of another mode of connecting the sheets together. In this instance, the ends are bent, and catch the one under the other; and when all the parts are well cemented together by the India-rubber, this will form a very secure and yet simple connection. It has been already stated that the surfaces of the sheets of steel or other metal, after being properly cleaned, are coated with brass; it therefore only remains to state that the rubber compound is to be applied as a covering of the steel, as shown in the drawing, and the article, thus prepared, is submitted to the vulcanizing process, in the ordinary manner.

When short bands, that can be made from one length of steel or other metal, manufactured, as before stated, without joints, are required, it will only be necessary to connect together the two ends of a band, of suitable length, by means of rivetting or otherwise, so as to form an endless band.

The patentee claims, "the mode, above described, of combining sheet steel, or other suitable metal, and vulcanized India-rubber for the manufacture of bands for the purposes set forth."

*To EDMUND TATHAM and AMOS TATHAM, both of Ilkeston, Derbyshire, for an improvement in warp machines for the manufacture of looped fabrics.*—[Dated 28th October, 1862.]

THIS invention consists in the employment of metal bars or levers, as hereafter described, instead of strings, for dividing and pushing aside the spring guides in warp machines, as required, according to the pattern to be performed. The levers are free to play upon fixed points, and have motion communicated to them from the jacquard through strings connected to the long arms of the levers.

In Plate III., fig. 1 shows, in side elevation, and fig. 2 in plan, so much of the parts of a warp machine as is necessary to illustrate this invention. *a*, is the guide bar; *b, b*, are the guides cast in lead *c*, and attached to the guide bar *a*; *d, d*, are stationary fingers or stumps, also cast in the lead *c*, one of which is placed between every two guides; and *e, e*, are brass or other metal division plates, cast in a lead secured to the upper rail *f*, of the guide bar *a*. These brasses have a hole made through them, for the reception of a spindle *g*, which forms the fulcrum on which the metal bars or levers *h, h*, work. The levers *h*, one of which is shown detached at fig. 3, have a hole bored through the long arm, to receive a string, whereby motion is communicated to them from the jacquard. The short arm terminates in a turned-down wedge *a\**; and on the long arm of the levers, or any of them being raised, the wedge *a\**, is consequently depressed, and pushes the particular guide or guides, on which it or they act, aside. *i*, (fig. 1) shows the line of needles, and *k*, the leads fixed in a needle bar, not shown; *l, l*, are lugs cast in the lead, fixed to the upper rail *f*, formed with eyes for receiving a pin *b*, which is held over the short arm of the levers *h, h*, to prevent that arm being raised too high upon the wedges *a\**, being withdrawn from the guides. A bar, not shown, is used to depress the long arm, and consequently raise the short arm of the levers, so as to withdraw and raise the wedges *a\**, when required.

The patentees claim, "the employment in warp machines of levers made to act substantially in manner and for the purpose described."

*To WILLIAM TRISTRAM and HENRY BRERETON, both of Halliwell, near Bolton-le-Moors, Lancashire, for improvements in machinery or apparatus for sizing yarns and threads.*—[Dated 11th December, 1862.]

THIS invention is applicable to the machines known in the trade as "slashers" and tape machines, which machines are employed for sizing and drying yarns and threads, and winding them on to beams,

The invention consists in the application of a revolving brush, which acts on the yarn or thread immediately after it has passed the rollers by which the size is applied, and by which the surplus size is squeezed out: the brush rotates rapidly, and the yarn is pressed into the bristles by means of a rod connected to a swing frame, the position of which can be varied, so as to increase or reduce the depth to which the yarn is pressed into the bristles. Below the revolving brush is another brush, which revolves slowly in a trough containing soap and water, or other liquid, for clearing the brush acting on the yarn, and keeping it moist.

The effect of the revolving brush acting on the yarn, immediately after the size has been applied to it, is to lay the fibres, and to distribute the size evenly on each individual thread.

In Plate IV., fig. 1 is a side view of a slasher or tape machine, to which the improvements are applied; fig. 2 is a section; and fig. 3 an end view of the same. *a*, represents the yarn to be sized; *b*, is one of the usual rollers, revolving in a trough containing the size; *c*, and *d*, are the ordinary heated tin cylinders, around which the yarn passes; *e*, *f*, *h*, and *i*, are guide rollers; and *g*, is a friction roller, by which the yarn is regulated in laying on to the beam on which it is wound, as is now customary.

The improvements consist in the application of the revolving brush *j*, which acts on the yarn immediately after the size has been applied to it: the yarn is pressed into the bristles of the brush *j*, by the rod *k*, connected at each end to the levers *l*, which are jointed to studs fixed in the side standards *m*. The levers *l*, also support the rods *n*, and *o*, to the latter of which the rod *p*, is suspended. These levers and rods form a swing frame, which is connected to the cross shaft *q*, by a cord passing around it and secured to the rod *n*. The brush *j*, is made to revolve rapidly, or at the requisite speed for distributing the size and laying the fibres on the yarn or thread, by the straps *r*, and *s*, the latter of which passes over a pulley on the driving strap *t*, or in any other convenient manner; and the brush *j*, is kept clean and moist by a second brush *u*, which revolves very slowly in the trough *v*, containing soap and water or other liquid. The requisite motion is given to the brush *u*, by a worm on the axle of the brush *j*, gearing into a pinion on the side shaft *w*, (see fig. 3) to which is also fixed a worm, gearing into a pinion on the axle of the brush *u*.

In fig. 1 the swing frame is shown in its proper position for holding the yarn on to the brush *j*, so that, when the brush revolves, the bristles penetrate between the yarns, and distribute the wet size evenly on each individual yarn; consequently, when dried by passing around the cylinders *c*, and *d*, they do not so frequently adhere together, as in slashers or tape machines of the ordinary construction.

When it is requisite to raise the yarn or thread above the brush *j*, the attendant, by partly turning round the cross shaft *q*, winds up the cord attached to the rod *n*, thus raising the swing frame into the position shown in fig. 2.

The patentees claim, "the application and use of a revolving brush to the machines, for sizing yarns and threads, called 'slashers' or tape machines, in the manner and for the purposes described."

*To JULES JOSEPH LAVEISSIERE, of Paris, for improvements in the manufacture of tubes of copper, or other metals or alloys.*—[Dated 5th November, 1862.]

THIS invention relates to the manufacture of tubes from hollow ingots, or cylinders of metal. In order to obtain a sound hollow ingot or cylinder, the requisite quantity of the melted metal is run into a mould of the shape required for the exterior of the ingot. When the metal is nearly set, a mandril is forced down into the metal. The mandril is not, however, forced quite to the bottom of the mould, so that one end of the ingot will be closed; or it may be made with an internal flange only at its end. The metal is thus compressed, and the volume displaced by the mandril is caused to rise up around the core, and to fill the mould. As soon as the metal has sufficiently set to retain its shape, the mandril is raised from the mould. In order to draw out the hollow ingots into tubes, grooved rollers are employed, between the grooves of which the ingot is either pushed or drawn by a mandril forced forward in any suitable manner.

In Plate III., fig. 1 represents in side view an arrangement of machinery for producing hollow ingots by pressure. *b*, is the mandril, represented as having been introduced and withdrawn from the mass of metal *c*, which has taken the form *c*<sup>1</sup>. *d*, is a press screw, operated by toothed wheels *e*, *f*, and the gearing *g*.

Fig. 2 is a section of a mould *a*, provided with a receptacle at the side. By the means above set forth, sound hollow ingots of copper and other metals and alloys are obtained with certainty, even when the material is such as to render it very difficult to cast sound ingots in the usual manner.

Fig. 3 represents, in side view, an arrangement of rollers, for elongating the hollow ingots produced by pressure, as already explained. The horizontal grooved rollers *a*, *a*, may either be fixed upon their axles or provided with independent axles. The vertical rollers or cylinders *b*, *b*, may also have fixed or independent axles. The mandril *c*, with the hollow ingot upon it, is, as has been described, forced by a press *d*, or other suitable means, between the rolls; or it may be drawn through by a chain *e*, or otherwise. In this latter case, the ingot or cylinder of metal *f*, which is shown entirely closed at one end, should be open at the part *g*, to admit the rod by which the drawing forward of the mandril is effected. *h*, is a guide, upon which the ingot or cylinder of metal *f*, rests during the introduction of the mandril *c*.

The patentee claims, "the making tubes of copper or other metals or alloys, by forming hollow ingots by casting and pressing the semi-fluid metal, as set forth, and afterwards drawing or elongating such ingots. Also the drawing or elongating such cast ingots closed at the end or with an internal flange, by forcing or drawing them by means of a mandril between grooved rollers, as described."

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*To WILLIAM LONGLEY, of Leeds, for improvements in machinery for making bricks.*—[Dated 25th November, 1862.]

THIS invention relates to a novel arrangement of brick moulding machinery, whereby bricks produced from "wet" clay will combine great

solidity with a smooth exterior, and contain a less amount of moisture than those produced by hand or by machinery at present in use.

In Plate III., fig. 1 is a side elevation of the improved machine; fig. 2 is a partial end elevation, showing in longitudinal section the cylinder which carries the moulds, and presents them successively to a conical hopper to be fed with clay; fig. 3 is a cross section of the mould cylinder, showing its connection with the hopper; and fig 4 shows the means used for locking the cylinder, so as to keep the moulds stationary while being filled and discharged.

A, A, is the main framing of the machine, upon which is mounted, in suitable bearings, a horizontal cylinder B. This cylinder is cast with open ends, and it is fitted near the middle of its length with a series of four moulds c, c, arranged radially around it. These moulds are formed by recesses cut through the periphery of a projecting band a, a, that surrounds the cylinder, having their ends closed by the rings b, b, (bolted to the cylinder). A series of close chambers D, D, are formed in a similar manner between the moulds for receiving steam for heating the moulds. Immediately above this concentric projection of the cylinder B, and in close proximity thereto, is situate the hopper E, in which a screw is mounted for forcing down the clay into the moulds as they are presented to the hopper. Fitted into the moulds are plungers F, the stems of which project through the inner periphery of the cylinder B, and are intended for discharging the bricks from the moulds. The inner periphery of the cylinder B, is also pierced to receive the ends of a cruciform arrangement of steam pipes G, (fig. 3) for supplying steam from a central pipe running in the direction of the axis of the cylinder to the chambers D. An intermittent axial motion is given to the cylinder, for the purpose of bringing the moulds severally under the hopper to be filled, and subsequently under the action of a rocking presser lever H, for the discharge of the moulded bricks, in the following manner:—To one end of the cylinder (outside the framing A,) is keyed a kind of ratchet wheel B<sup>1</sup>, having four teeth, one of which takes into a stud pin fixed to the extremity of a bent arm K, which arm is jointed to a rock lever K<sup>1</sup>, having its fulcrum on a stud projecting from the side framing. A bowle on this arm K, rolls over a track formed by the boss of a cog wheel B<sup>2</sup>, (hereafter to be referred to) and thus the smooth working of the ratchet movement is ensured. In the inner face of the lever K<sup>1</sup>, a longitudinal recess is cast to receive a guide pin projecting from a crank arm L, on a transverse cam shaft L<sup>1</sup>, which turns in suitable bearings in the main framing. To the opposite end of this shaft is keyed a cog wheel L<sup>2</sup>, with internal teeth, into which gears a pinion on the boss of a bevil wheel M, mounted on a stud axle, carried by the main framing. This wheel M, is driven by a bevil pinion, which receives its motion from any prime mover. It will now be understood, that for every rotation of the cam shaft L<sup>1</sup>, the arm K, will be caused to pull round the cylinder B, one-fourth of a revolution, and then move forward to bring its stud pin in front of another ratchet tooth. When the uppermost mould c, has been filled by the driving down of clay from the hopper E, through the rotation of the propelling screw, this axial motion of the cylinder takes place, and at that moment a knife edge, situate at the bottom of the hopper, scrapes the lips of the mould clear of clay. The mould is now brought down opposite a horizontal plunger N, and by it the clay is compressed in the mould. The

rod of this plunger N, slides in a fixed guide, and it is fitted with a bowle, which is kept in contact with a cam L<sup>2</sup>, on the cam shaft, by means of a weighted crank lever, with which the plunger rod is connected. As the increasing radius of this cam presses on the bowle, the plunger will be forced forward into the mould presented to it, and compress the clay contained therein. When this is effected, and the cam L<sup>2</sup>, in its revolution has passed out of action, the weighted crank lever will draw back the plunger N, out of the mould. Another movement of the cylinder B, will now take place, and the compressed brick will be brought down to the position for being discharged on to an endless apron O. This is effected by the stem of the plunger R, of the mould being pressed upon at its rear end by a rock lever H, mounted on a bent bracket arm attached to the main framing; it is provided with a bowle, which bears upon a rocking cam H<sup>1</sup>, (see fig. 4) having a stud pin on the framing for its fulcrum. This rocking cam H<sup>1</sup>, is jointed to a rod H<sup>2</sup>, which connects it with a rocking arm H<sup>3</sup>, pendent from a bracket on the framing. The arm H<sup>3</sup>, carries a bowle, which bears against a cam L<sup>3</sup>, on the cam shaft. The revolution, therefore, of the cam shaft gives a reciprocating motion to the cam H, thereby causing it to rock the lever H, and depress the plunger that has been brought beneath its inner end. This depression of the plunger effects the discharge of the brick, which is facilitated by the heating of the moulds, through the admission of steam, as before explained. To prevent the adherence of the clay to the compressing plunger, that is also made hollow, and steam is conveyed thereto by an arrangement of jointed steam pipes, as shown at fig. 1. The discharged brick is received on to an endless apron, which receives motion from the spur wheel B<sup>2</sup>, on the cylinder B, gearing into a spur wheel on the axle of one of the carrying rollers of the endless apron O. The cylinder B, is also furnished with a ring B<sup>3</sup>, in the periphery of which are four notches, corresponding with the moulds. These notches (see fig. 4), are for the purpose of receiving the taper end of a locking bar P, which, when it is desired temporarily to lock the cylinder (as at the moment of filling, pressing, and discharging the moulds) is thrust forward by a cam L<sup>4</sup>, on the cam shaft pressing upon a bowle, mounted on the end of the locking bar, which slides in guides provided to receive it. The release of the cylinder is effected by throwing back the locking bar by means of a weighted crank arm, as in the case of the compressing plunger.

The patentee claims, "the construction of machinery above described, whereby the moulding of bricks, and their discharge from the moulds, is effected in a simple and expeditious manner."

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*To JOHN CAMPBELL ROBERTSON, of Gracechurch-street, and WILLIAM CORNWELL WHITE, of King-street, Regent-street, for an improved tap or cock.*—[Dated 29th November, 1862.]

THE object of this invention is to render taps self-closing, in order to prevent the escape or waste of the contents of a cask or barrel, or of water, from ordinary household taps, or of any fluid, through accidental circumstances or negligence, in leaving the tap or cock open or turned on. The upper part of the plug holder of the tap is enlarged, so as to form a circular chamber therein, in which is placed a helical spring,

either of flat steel, similar to a watch spring, or of round wire, and the same is fixed to the interior surface of the chamber by means of a stop or stud. The plug of the tap is furnished with a similar stop or stud, taking into a slot cut in the other end of the helical spring; or, in case of round wire, taking into a ring formed by turning over the end of the wire. A moveable cap encloses the top of the chamber, and the under surface of this cap has fixed or soldered thereto a small projection corresponding with a stud on the top of the enlarged surface of the plug contained in the chamber.

The action of the tap is as follows:—The spring is to be wound up by turning the handle of the tap; after which the cap is to be let down into the chamber, and fastened therein. The stud on the upper surface of the plug abutting against the projection on the lower surface of the cap, serves to stop the plug from turning beyond it; and the situation of the respective stops being suitably arranged, it will result, that when the tap is turned against the action of the spring, to withdraw a liquid, the handle, when released, will be forced round by the spring to the stop, and close the tap.

According to the foregoing arrangement, it is obvious that the tap can only be opened by turning it in one direction; but the taps, by a modification of the above, may be made capable of being opened by turning the handle in either direction. To accomplish this, the stops on the upper surface of the plug and the under surface of the cap, are taken away; and in lieu of the helical spring two spiral springs are applied, each fixed at the back of the interior of the chamber, and each passing half round the same, and meeting in front: they are held in position by means of a circular wire fixed in the chamber, and around which wire the springs are placed. The plug is provided in front with a projection or stud taking into the extremities of the spiral springs, by which means, in whichever direction the handle is turned, the springs will, when it is released, force it back to its closed position, and retain it accordingly.

In Plate IV., fig. 1 is a vertical section of a tap, containing a helical spring in the chamber. *a*, is the plug, and *b*, a projection or stud thereon, attached to which is the spring *c*: when the plug is turned against the action of the spring *c*, (the other end of which is attached to the chamber) and released, it is returned to its closed position by the spring, and held against the projection *d*. Fig. 2 shows, in plan view, an arrangement of spiral spring in the chamber. The spring is fixed at the point *a*; and the projection *b*, on the plug, actuates the spiral in either direction, causing the plug, when released, to assume the closed position. Figs. 3, 4, 5, 6, 7, and 8, show the component parts of a plug chamber, and duplicate spring actuators. The plug has a portion of the periphery removed, as shown at *c*, (fig. 3) leaving the two sides *d*, prominent, in order to bear against the studs *d*<sup>1</sup>, (figs. 6 and 7) which are respectively upper and under plan views, and which are placed on the plug in the chamber in a reversed position, as shown in the elevation fig. 8. Duplicate reversed helical springs are attached to the tongues *e*, (figs. 6 and 8) and the other ends thereof are held in a similar manner by the tongue *f*, (figs. 4 and 5) situated within the chamber *g*. *h*, is a stop block, against which the projecting parts *h*<sup>1</sup>, (figs. 6 and 7) bear.

The action is obvious: the tap may be turned in either direction, and will be closed by one of the helical springs, which surround each of the



parts, figs. 6, 7, and 8. Fig. 4 is a plan view of the chamber; *k*, is a nick cut in the periphery for a spring stop *l*, (fig. 3) to enter by pressure of the finger, and keep the tap open when a quantity of liquid is required to be withdrawn.

The patentees claim, "the general combination and adaptation of parts described and shown hereby, or any modifications thereof, substantially the same for effecting the objects specified."

*To MICHAEL HENRY, of Fleet-street, for improvements in fitting or applying propellers to ships and other vessels,—being a communication.—*

[Dated 13th December, 1862.]

THE object of this invention is to fit or apply propellers to ships and other vessels in such manner that the position of the propeller or direction of its axis with respect to the ship or vessel may be varied, so that the propeller may be turned or worked like a rudder, or its axis placed at various angles to the direction of the fore and aft line of the vessel. Another object of the invention is to fit propellers in such manner that they may be raised and lowered bodily, and thereby more or less submerged. By the arrangements herein described, a vessel may be brought round in a small circle, and perform other evolutions with ease and safety.

In Plate IV., fig. 1 is a side elevation, showing the improved arrangement for fitting propellers. *a, b, b'*, is a frame, fixed to and projecting from the vessel's stern *s*; *e*, is an upright axle, stepped in the frame piece *b*, and passing through a collar in the frame piece *a*; *E*, is a frame, capable of turning like a rudder on the axis *e*. On the upper end of the frame *E*, is a toothed segment *d*, in gear with a toothed pinion *c*, on a shaft *c'*. *f*, is a boss on the axle *e*, having on one side a bearing or socket, which receives one end of the screw propeller shaft *g*. This shaft passes through the frame *E*, and carries the propeller *A*, which may be of any desired form; *H*, is the driving shaft; *k*, a toothed pinion, keyed to the shaft *g*, and in gear with a toothed wheel *i*, on the axle *e*. This wheel *i*, is also in gear with a toothed wheel *h*, on the shaft *H*, which thus communicates rotary motion to the propeller. The propeller may be moved, at an angle to the direction of the vessel's fore and aft line, by turning the shaft *c'*, whereupon the pinion *c*, will work the segment *d*, and thereby move the frame *E*, and with it the shaft *g*, and propeller *A*, in the desired direction, in which position the rotation of the propeller by the gearing *h, i, k*, will not be interfered with. *M*, is a conical shield, fixed on the shaft *H*, and having its outer surface corrugated with spiral flutings: its object is to throw off extraneous bodies, and so protect the wheelwork.

Fig. 2 is a side elevation of a modification, showing arrangements by which propellers may be more or less submerged. In this modification, the upright shaft *e*, on which the frame *E*, turns, is supported in a frame *B*, which may be slidden up and down in guide grooves in the stern *s*, by any ordinary contrivance. The frame *E*, and arrangements *d, f, k, g*, and *c'*, are similar to those marked with like letters in fig. 1. *H*, is the driving shaft; *p*, is a long pinion on the shaft *c'*, in gear with the segment *d*, and working the frame *E*. This pinion *p*, passes through a slot in the frame *B*, so that the frame *B*, may be slidden over the

pinion. The frame B, is also slotted, for the shaft H, to pass through, the slot being of sufficient length to allow the frame, when slid up or down, to travel over the shaft H. The axle e, carries a toothed wheel m, in gear with a toothed wheel l, keyed on the shaft H. The wheel m, is fitted on the axle e, with a feather, to allow the shaft to rise or descend with the frame B. n, is a bevil wheel, keyed on the axle e, and in gear with the pinion k: the shaft H, transmits rotary motion to the propeller, through the arrangements l, m, e, n, and k. The propeller is raised or lowered by sliding the frame B, up or down in its guide grooves. The axle e, boss f, and propeller shaft g, move with the frame B, but their change of position will not affect the action of the gearing l, m, n, k, d, and p, and therefore will not interfere with the rotation of the propeller, or with the turning of the frame E.

The patentee claims, as the improved mode of fitting or applying propellers to ships and other vessels, "arranging and combining apparatus for that purpose, in manner described."

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To ALFRED VINCENT NEWTON, of 66 Chancery-lane, for improvements in *machinery for cutting corks*,—being a communication.—[Dated 22nd November, 1862.]

THE object of this invention is to cut by a machine, directly from a slab of cork wood, corks, either of cylindrical form or of any degree of taper that may be desired.

In Plate IV., fig. 1 is a longitudinal vertical section of the cork-cutting machine; fig. 2 is an inside face view of one of the cutters; fig. 3 is an end view of the same; and figs. 4 and 5 illustrate the method of cutting ring-shaped or shell corks. A, is the bed plate, on which are two head stocks B, and C, one of which contains the bearings for the rotating cutter spindle D, and the other supports the back spindle E, which only has a longitudinal movement. The rotating cutter spindle D, has firmly secured on it a pulley F, for the reception of a driving belt, through which it receives rotary motion, and a disc G, for carrying the clamps by which the cutters J, J, are clamped to the pattern I. There is also fitted to the spindle D, in such a manner as to be free to slide longitudinally upon it, a disc H, to which the heads of the cutters J, J, are connected. The pattern I, is secured to the end of the spindle D, next the back spindle. The pattern represented is of conical form, but it may be changed for one of cylindrical form of any size, or for a larger or smaller one of conical form, according to the form and size of the corks to be cut, as it regulates both the size and form of the corks. It is secured to the end of the spindle concentric with it by means of a screw a, passing longitudinally through its centre and screwing into a tapped hole in the end of the spindle; and it is caused to turn with the spindle by means of a steady pin b, which is fast in the end of the spindle, and enters a hole in the butt end of the pattern.

The cutters J, J, are made of long pieces of steel plate, curved transversely in the form of arcs of circles, and their cutting edges are at the ends next the back spindle E. The radii of the arcs of their inner faces should correspond nearly with the radii of the circles of the corks to be cut, and, hence, two or more cutters, or sets of cutters, of different sizes, will be necessary for

a machine to cut corks of greatly varying sizes; though one cutter or set of cutters will serve to cut corks varying considerably in size. The disc H, to which the heads of the cutters are connected, is bored out cylindrically, to fit easily, and slide upon, a cylindrical portion of the shaft D; and its face is grooved radially, for the reception of the plates K, K, at the inner ends of which there are tongues, to enter longitudinal grooves in the shaft. These plates are secured to the disc by screw bolts c, c, and compel it to turn with the shaft, but yet permit it to slide longitudinally thereon. The plates are made with protuberances d, d, large enough to be drilled radially to the axis of the shaft, and tapped for the reception of screw pins e, e, which, by entering holes f, f, provided in the cutters, near the heads thereof, connect the cutters with the disc H; the connection permitting the heads of the cutters to come in contact with the plates K, K, that the said plates may press directly upon the cutters, to force them into the slabs of cork wood presented to the action of the machine. The cutters pass freely through the openings g, g, in the disc G, and fit into slight longitudinal grooves provided in the pattern, for the purpose of compelling them to rotate with the pattern and the spindle D. L, L, are the clamps, for securing the cutters to the pattern, made in the form of portions of a longitudinally-divided cylinder, to fit or nearly fit the exterior surfaces of the cutters. They are pivoted on pins h, h, at the middle of their length, carried by levers M, M, which are attached by fulcrum pins i, i, to strong studs N, N, rigidly secured to the disc G. At their other ends, the levers M, M, are fitted with set screws j, j, which, by being screwed down upon the studs N, N, are made to set the clamps down upon the cutters, and so caused to confine them to the surface of the pattern, but yet not to hold them so tightly as to prevent them from sliding along the face thereof in the cutting operation. The said clamps being pivoted at the middle of their length to the levers, are enabled to adapt themselves to the form of the pattern, and keep the cutters in contact with the whole length thereof, and so set them either parallel with, or at the required obliquity to, the axis of the rotating shaft, as may be required by the form of corks to be cut; the holes f, f, in the heads of the cutters, fitting the screw pins e, e, so loosely, as to permit the cutters freely to assume the requisite position. P, is the lever for producing the longitudinal movements of the back spindle E, and of the cutters. This lever has its lower end pivoted by a pin k, to a collar l, that is fast on a sliding rod Q, which is arranged parallel with and below the spindles D, E, in guides in the headstocks B, and C. This lever P, has provided in it an opening, through which the back spindle E, passes, and on opposite sides of this opening there are longitudinal slots m, for the reception of a pin n, which is inserted transversely through the back spindle; the said pin serving to connect the latter spindle with the lever. The rod Q, is connected with the hub of the disc H, by means of an arm x, which is rigidly secured to the rod, and furnished, at the upper end, with a yoke, fitting within a groove in the hub in such manner as not to interfere with the rotation of the disc H, and cutter spindle. The rod Q, is fitted in front and behind the headstock C, with two stop collars p, and q, to limit its longitudinal movement; and the back spindle E, is fitted in front and back of the headstock with two similar stop collars r, and s, to limit its longitudinal movement. When rotary motion is communicated to the cutter spindle D, the discs G, and H, the cutters, clamps,

and patterns all rotate with it. Before the slab of cork wood *s*, can be introduced between the pattern and the back spindle, the upper end of the lever *p*, is taken hold of by the operator and moved to the right, by which means, the back spindle *z*, is drawn back, till its stop *r*, comes in contact with the headstock *c*; after which the continued movement of the lever moves the rod *q*, to the left, till its stop *g*, comes in contact with the headstock *c*, and the rod is thus caused to draw back the disc *h*, and the cutters, until the points or cutting edges of the latter are brought over the pattern, as shown in fig. 1. The slab *s*, is then placed between the pattern and the back spindle, and by moving the upper end of the lever to the left, the back spindle is first brought forward and caused to clamp the slab against the end of the pattern, as shown in fig. 1; and then the rod *q*, is moved to the right, causing the disc *h*, and the cutters to move in the same direction upon the cutter spindle; the latter spindle having no longitudinal movement. This movement of the cutters presses them into the slab, and feeds them, as they cut thereinto by their rotary motion, until they have cut through the slab, which is made known by the stop *p*, coming in contact with the headstock *c*, and stopping the further movement of the rod *q*. The pins *e*, *e*, are relieved of strain in the above operation by the plates *k*, *k*, coming in contact with the heads of the cutters. The stops *s*, and *p*, should be so set as to limit the longitudinal movements of the spindle *z*, and rod *q*, in such a manner that the edges of the cutters cannot be pressed against the end of the back spindle and be injured thereby. When the cutters have cut through the cork, the upper end of the lever is moved to the right, and after having drawn back the spindle *z*, till the stop *r*, comes against the headstock *c*, it, by its action on the rod *q*, draws back the disc *h*, and withdraws the cutters from the slab, leaving the cork *t*, (fig. 1) free to be pushed out, when the slab has been removed from the pattern.

Fig. 4 is an end view of the pattern and the knives for cutting a ring-shaped or shell cork; the cutter *u*, nearest the axis of the rotating spindle, making a circular cut (represented by the smaller circle in fig. 5), and the cutter *v*, furthest from the axis, making a circular cut (represented by the larger circle in the same figure). *w*, (fig. 5) represents the ring-shaped or shell cork, being the piece which comes out of the slab between the two circular cuts; and *y*, represents the smaller solid cork, cut from the interior of the shell cork.

The patentee claims, "the means above described for cutting cylindrical, taper, and ring-shaped or shell corks."

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*To WILLIAM EDWARD NEWTON, of 66 Chancery-lane, for an improved method of firing or discharging cannon and other fire-arms; a part of which invention is applicable generally to the firing of charges of powder,—being a communication.*—[Dated 3rd January, 1863.]

THE first part of this invention relates to the firing of cannon and other fire-arms by means of currents of electricity, and without the use of a vent or touch-hole. The second part of the invention relates to the fuse, by which a charge of powder, wherever desired, may be fired, through the agency of electricity.

A longitudinal section of a cannon, fitted with the improvements, is  
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shown in Plate III. In the rear end or breech of the cannon *a*, and in line with the axis of the bore, a conical hole, extending entirely through to the bore, is made. This hole is reamed out to a conical form with the greater diameter inside, as shown. To this hole is accurately fitted a conical plug of metal *b*, the periphery of which is to be coated with some suitable non-conductor of electricity. It has been found, that enamelling the surface of the plug, in the same way and by the same means as is generally used for enamelling iron wire, answers the purpose well.

The metallic surface of the inner end of the plug should be left uncovered. This metallic plug *b*, when fitted into the conical hole, is secured by means of a nut *c*, or other suitable means, on the outside.

It will be evident, that the only effect of the force of the discharges on the inner end of this plug will be to drive it in tighter. To the outer end of this plug is attached a conducting wire *d*, leading to a magneto-electric machine or battery, or other source of electricity.

The cartridge or charge of powder *e*, is provided with a fuse *f*, which constitutes the second part of the invention.

The fuse is formed by connecting the ends of two metallic conductors by means of a feeble conductor, in contact with the charge of powder, or separated therefrom by some equally combustible matter. *g*, represents a block of wood, which may be termed the holder, and into which are inserted two copper wires *h*, *h'*. These wires should be about three-sixteenths of an inch apart, from centre to centre, and the edges of the extreme ends of the wires should be completely in contact with the wooden holder *g*. The other ends of the wires are left to project from the block to a sufficient length, for a purpose to be presently described.

The feeble conductor, for connecting the extreme ends of the two copper wires *h*, *h'*, consists simply of a mark on the end of the holder *g*; such mark extending from one wire to the other, and made with a pencil of the softest and purest plumbago.

The holder *g*, is surrounded with paper, extending sufficiently beyond the end of the holder to form a small case *j*, to hold a small charge of powder in contact with the feeble conductor.

When a current of electricity is induced, in passing through the plumbago mark, or other feeble conductor, it will ignite a portion of the metal mark, and produce a break with an intense flash, which will ignite the contained charge of powder. To protect the ends of the conducting wires *h*, *h'*, and the plumbago line from oxidation and injury, they may be coated with collodion or other equivalent substance.

The fuse *f*, thus formed, is placed, by preference, at about the centre of the cartridge *e*, with one of the conducting wires *h*, extending in a coil through, so as to project slightly from the rear end of the cartridge, in order to insure its coming into contact with the metallic face of the plug *b*, at the breech of the cannon, when the cartridge is rammed home. The other conducting wire *h'*, is extended through the cartridge, and projects from the side or periphery of the cartridge to such an extent as to insure its being in contact with the bore when charged into the cannon.

It will be seen that one of the conducting wires of the fuse *f*, is in contact with the inner end of the conical plug *b*, which is in connection with the conducting wire *d*, leading to one pole of a magneto-electric machine or galvanic battery; and the other conducting wire *h'*, of the fuse is in

contact with the bore of the gun. The two wires are insulated by the non-conducting coating of the conical plug, and, therefore, when the butt of the cannon is connected with the other pole of a magneto-electric machine or battery, either by the ground connection or by another conducting wire, and the electric circuit is established, the current, on reaching the point of one of the wires, will be conducted to the other wire  $A^1$ , of the fuse, by the pencil mark on the holder  $g$ ; thereby causing a flash or spark, which will instantly ignite the charge of gunpowder.

The patentee claims, "combining, with the barrel of the cannon or other fire-arm, an insulated plug, extending through the metal from the bore to the outside; such insulated plug to be used with a cartridge having a fuse provided with two conducting wires, so that, when inserted in the bore, one will be in contact with the bore and the other with the insulated plug, as set forth. Secondly,—the connection of two conducting wires by a feeble or film-like conductor, whether such interposed feeble conductor be placed directly in contact with the powder or with a combustible substance interposed, substantially as described."

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### Scientific Notices.

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#### INSTITUTION OF MECHANICAL ENGINEERS.

(Continued from page 41.)

THE next paper read was, "*On the construction of submarine telegraph cables*," by Mr. FLEEMING JENKIN, of London.

THE submarine telegraph cables that are now in successful operation are nearly all of one general construction; and this description of cable will be first referred to in the present paper. The only essential parts of a submarine telegraph cable are—first, a conductor, along which the electricity may flow from one station to another; and second, an insulator, surrounding the conductor and separating it entirely from the sea. In the common cable a wire or strand of copper forms the conductor, which is covered and insulated by gutta-percha. This core of gutta-percha covered wire is served with tarred yarn, round which a greater or less number of iron wires are laid spirally, to afford longitudinal strength and lateral protection.

The Malta and Alexandria telegraph cable, laid in 1861, will illustrate this class. The copper conducting core is surrounded by three coatings of insulating gutta-percha. Copper is used for the conductor, because it resists the passage of electricity less than any other available metal. Different specimens of copper vary greatly in their resistance; some commercial copper has, in this respect, only 14 per cent. of the value of chemically pure copper, or is 86 per cent. inferior to the latter, which, however, cannot be practically obtained in commerce. The course followed by the principal manufacturers of telegraph cables is to select, by an electrical test, the wire best suited to their purpose;

and this wire is about 20 per cent. inferior in conducting power to pure copper.

A solid wire would be preferable electrically to a strand, for the same reason that copper of small electrical resistance is preferable to copper of high resistance; the object being in all cases to obtain the greatest conducting power within a given circumference. The interstices in the strand diminish the conducting power for a given size, and the gutta-percha sheath must be of proportionately larger diameter, to give the same speed of transmission and the same insulation as when a solid core of equal weight is used. When large conductors are required, however, a solid wire is not found flexible enough; and, moreover, a single copper wire is found liable to break inside the gutta-percha, without any external symptom of injury being seen: for these reasons a strand is almost universally adopted for large cores.

In the cables first made, the interstices between the wires of the strand were left vacant; but it was found that, under continued pressure, the water invariably penetrated into these vacant spaces and percolated along them. This was thought dangerous, for various reasons, and therefore the Gutta-percha Company now lay up their strand in an insulating compound, called "Chatterton's compound," consisting of gutta-percha and resinous substances, which so completely fills the spaces, that a pressure of 600 lbs. per square inch cannot force a single drop of water six inches along the finished core. Other makers have adopted the same plan; but the Red Sea cable and several earlier cables are without it.

In reference to the electrical conditions determining the best dimensions of the conductor and its insulator, it is sufficient here to observe, first, that for every given ratio between the cost of the materials of the insulator and of the conductor there exists a corresponding ratio between the diameters of the conductor and insulator, which will give the maximum efficiency at a minimum cost; and practically the thickness of the gutta-percha is almost always in excess of this theoretical thickness. Secondly, if a constant ratio is maintained between the diameters of the conductor and insulator, the number of words per minute which can be sent through a given length of core is simply proportional to the quantity of the materials used; so that a core to transmit twenty words per minute will weigh four times as much, and cost about four times as much as a core to transmit only five words per minute.

The manufacture of the copper-conducting strand is extremely simple. Owing to the soft nature of the metal, it seems to be of little importance whether the wire is twisted in making the strand, or not; although in the outer iron sheathing of the cable, it is of special importance for the wires to be "laid" without twist. In the simple form of strand machine, a friction break restrains the movement of each bobbin, and is adjusted by hand, until the spinner feels that the tension of each wire is equal. The drums of the bobbins are made large in proportion to their total diameter when full of wire, so that the leverage of the break does not vary rapidly during the unwinding of the wire. It is important that every wire of the strand should be put in with a constant and equal strain, otherwise one wire will sometimes ruck up during the subsequent covering process, and knuckle

through the insulating covering. Each length of wire is soldered to the next length, so that there may be no loose ends which might come through the gutta-percha. Where one piece of strand is joined to the next, a scarf joint is made, lapped round with binding wire, and neatly soldered.

In covering the strand, the gutta-percha is applied in a plastic state, in successive coatings over the strand, which is for this purpose drawn through a series of dies, each one in succession larger than the preceding; and between the several layers of gutta-percha a coating of Chatterton's compound is laid on. The Atlantic cable, the Varna, Corsica, and some other cables, have a solid covering of gutta-percha, and no Chatterton's compound is used. The Red Sea cable, and several earlier cables, had the compound between the coats of gutta-percha, though not between the wires of the copper strand: the latest cables have both.

When india-rubber is employed as the covering, it is applied in strips wound spirally round the strand in most cases; but it is put on longitudinally in the plan invented by Mr. Siemens, and described at a former meeting. Solvents were at one time used to joint the strips of india-rubber, but they are now generally cemented into a solid mass by heat applied in various ways. In Mr. Siemens's plan, the simple contact under pressure of freshly-cut surfaces of india-rubber is said to be sufficient to join the longitudinal strips without the use of extra heat or solvents.

The question of the relative merits of the two materials, gutta-percha and india-rubber, for the covering of telegraph cables, is one of much practical interest. Gutta-percha sometimes contains impurities, and air bubbles were at one time not uncommon in the covering with that material; these air bubbles and impurities become serious faults under the action of powerful electric currents. Gutta-percha becomes plastic at about 100° Fahr., and the copper wire sometimes forces its way through the insulating sheath when the gutta-percha is accidentally softened by heat; moreover, joints unskilfully made are liable to decay in time. On the other hand, the merits of gutta-percha are very great. Not a single yard of submerged gutta-percha has ever decayed; and the importance of this fact, after the experience of many years on some thousands of miles of wire, can hardly be over-estimated. No gutta-percha cable has ever failed, except from local imperfection or accidental injury; two causes of failure to which all known materials must be subject. The insulating properties of gutta-percha, as now supplied, are extremely good. No known material insulates perfectly; but if 2000 miles of the same gutta-percha covered core that was supplied for the Malta and Alexandria cable, perhaps the best yet constructed, were laid, say, across the Atlantic ocean, and were maintained at the very improbable and disadvantageous temperature of 75° Fahr., the current received through that cable would amount to 97½ per cent. of the current which would be received through a cable with absolutely perfect insulation. Roughly speaking, it may be said, therefore, that the insulation of that cable was, for a length of 2000 miles, within 2½ per cent. of perfection.

It may be remarked here, that the word "insulation" has frequently been used in a double sense; first, as implying freedom from mechani-



cal defect or impurity; and, secondly, as implying electrical resistance. Consequently, some statements that are true, when the word is used in one sense, have been incorrectly applied with the word in the other sense, causing some confusion in the comparisons of gutta-percha and India-rubber. Thus, the circumstance that India-rubber is a better insulator, in consequence of having a higher electrical resistance than gutta-percha, has, in mistake, been incorrectly taken to mean that India-rubber is the better material for covering telegraph cables; whereas, the words "better insulator" imply properly, in this case, a superiority in the one respect of non-conducting power alone, and not a general superiority in all respects.

The defects of India-rubber differ with different makes: some kinds are liable to turn into a treacy substance on the outer surface and next to the copper; others are liable to little cracks or fissures, which appear only after the cable has been manufactured for some time; and other kinds turn slimy in water, arising, it is said, from a considerable absorption of water. The cause of these defects does not seem well understood, and various reasons have been assigned by different makers. Exposure to light and air is generally allowed to be injurious; but, in the author's opinion, the real causes of failure in India-rubber covered cables must be considered not yet satisfactorily ascertained. One defect is common to all forms of India-rubber covering, namely,—the necessary difficulty of making the continuous joint which is required along the whole wire; and another defect, common to all forms of non-vulcanized India-rubber, is the liability to injury from grease or oil. The latter danger is of the most insidious kind, for the injury is not immediately apparent, but requires a long time for its full development.

The merits of India-rubber, however, are not to be passed over lightly, and, if they do not justify its general adoption as yet, they certainly entitle it to all the attention it has received for the manufacture of telegraph cables. The most important point claimed in its favour is, that a greater number of words per minute can be transmitted through a wire covered with India-rubber than through the same wire covered with the same quantity of gutta-percha, of the usual quality. There is reason to believe that, in this respect, India-rubber is twice as good as any gutta-percha hitherto practically supplied for cables; but a few specimens of gutta-percha have certainly been manufactured which, even in this respect, are on a par with the best makes of India-rubber. An endeavour has been made by Mr. Siemens to obviate the defects, and retain some of the advantages, of India-rubber, by protecting it inside with Chatterton's compound, and outside with gutta-percha. In Mr. Siemens's cable, the copper strand is made up nearly to a circular form by the addition of six small wires, placed in the grooves between the six external wires of the strand.

The main practical question still is—which material offers the best chance of permanency; and at present, in the writer's opinion, the answer must be in favour of gutta-percha, which is supported by the fact, that the old telegraph companies continue to employ gutta-percha for their new cables.

The serving with hemp or jute yarns, as practised at present, is done by machines similar to those strand machines which put a twist into

the wire or yarn; and advantage is taken of the flexibility of the yarn to place the bobbins in any convenient position. A large number of yarns are used, put on with a long twist or pitch, in order to avoid any chance of bending or twisting the core, if one yarn breaks or is not so taut as the others. The serving merits more attention, in the author's opinion, than it has received, and he considers that many machines for manufacturing telegraph cables still put too much strain upon the core, especially when it is small and weak; and that the hemp might be applied so as to protect and strengthen the core much more effectually than is now the case, and thus form a much better preparation than is now afforded for the final process of sheathing with iron wires. The usual cores, both before and after they are served with the yarn, are very weak, and liable to be stretched if any hitch occurs in the feed of the machines; and the author believes, that several mishaps might be traced to this cause, and that the construction of a thoroughly good serving machine is a desideratum of much importance. The yarn, protected by wires, remains sound under water for a long time.

The final process of sheathing the cable with iron wire is similar to that of making wire rope; and the machines used for the one purpose answer for the other, with the simple addition of a guide for the central soft served core. All the machines used "lay" the wire without twisting it, the same as in the manufacture of wire ropes.

Only the commonest form of submarine cable has hitherto been described, consisting of one insulated conductor, served with hemp, and protected by iron wires laid round it. A description will now be given of some of the other forms that have been used or proposed.

Instead of one gutta-percha covered core, several separately insulated wires are frequently included in one sheath, as in the cable, laid in 1854, between Spezzia and Corsica. This cable has six insulated conductors, which are all now in working order; and the cable has not cost anything for repairs since first laid, and is still in constant work. The several insulated wires, in this and similar cables, are coated with gutta-percha, and then laid up with hemp worming into a strand by laying machines, similar in general arrangement to those for sheathing. The gutta-percha covered wire is, of course, not twisted, but the hemp generally is. The cables across the English Channel are generally of this class.

In the Atlantic telegraph cable, laid in 1857, the simple iron wires of the sheath were replaced by small strands, made each of seven wires of 0.028 inch diameter; but these were found objectionable on account of their rapid corrosion.

Strands, formed of thick wire, are, however, frequently used to cover heavy shore ends of telegraph cables, and are almost necessary in the largest cables for giving sufficient flexibility. The Holland cable about to be laid, the shore end of which weighs 19.6 tons per nautical mile, has an external protecting wire 0.220 inch diameter in the strands covering the shore end, while the single wires, covering the main cable, are 0.375 inch diameter; but, in the process of manufacture, the cable was wound round a 7-foot drum without difficulty.

In the Toulon and Algiers cable, laid in 1860, the iron wires of the sheath were replaced by steel wires, 0.085 inch diameter, each covered

by a tarred hempen strand. This form, though convenient in many ways, has been abandoned, because the marine insects eat away the hemp with great rapidity, leaving a mere bundle of loose wires. Simple hempen coverings have also been proposed, and, in a few instances unsuccessfully tried.

A single copper wire, however, 0·065 inch diameter, merely covered with gutta-percha, was laid successfully between Varna and Balaclava, in 1855, during the Crimean war—a distance of 300 miles, and worked for about nine months.

In a construction of telegraph cable, proposed by Mr. Allan, no outer covering of wires is used, but the gutta-percha covered wire is strengthened by a layer of small steel wires round the copper conductor. It is doubtful whether this plan is preferable to a simple copper strand, covered with gutta-percha: though superior mechanically, it is far inferior electrically.

The rapid corrosion of the outer wires, in some situations, when submerged, is perhaps the chief defect of the common type of submarine cable. To prevent this corrosion, the Isle of Man cable, and the Wexford cable, had a bituminous compound applied over the iron wires, on Mr. Latimer Clark's plan. The Isle of Man cable was passed through the hot melted compound, and was considered to have been injured in some places by having been accidentally delayed in its passage through the hot material. The Wexford cable was not passed through the melted mass, but had the compound thrown over it or basted on, and, by this simple contrivance, a very serious danger was avoided. This plan of preventing the decay of iron wires is fast coming into favour.

As a protection against rust, it has also been proposed to cover each of the outer wires separately with gutta-percha. A cable of this make, with strands composed of three iron wires, instead of single wires, in the sheath, was suggested, by Mr. Chatterton, for the new Atlantic line, and, except on the score of cost, seems well adapted for the purpose. It has also been proposed to protect the iron wires by vulcanite, applied either as a general coating or to each wire separately.

In a plan, introduced by Mr. Siemens, instead of protecting the iron wires, they are omitted altogether, and another material, considered more durable, is substituted. The core is surrounded with two layers of hempen strands, laid on under considerable tension. Three or more strips of copper or brass, about 0·01 inch thick, are then bound round these strands, while they are still stretched by the tension; and this copper or brass sheathing grips the hempen cords tightly, so that they cannot contract longitudinally after leaving the machine. By this construction, a cable is obtained which is extremely light and strong; thus, a cable,  $\frac{3}{4}$  inch diameter, bears a strain of 15 cwt. before breaking, and stretches only 0·8 per cent. of its length under a load of half the breaking strain. Mr. Siemens is of opinion that, from the experience obtained from the sheathing of ships' bottoms, the copper or brass strips outside this cable will be far more durable than the iron wires of the usual cable; experience, however, with telegraph cables can alone finally decide this point.

In sheathing cables with metal strips, two serving machines are used. These are placed one behind the other, and are driven in oppo-

site directions, laying on two distinct hemp coverings. The number of bobbins, or the size of the strand, in the two machines, is so adjusted, that each covering, although of different diameter, may have the same lay or pitch of the spiral. Each hemp strand passes round a V pulley, between the bobbin and the laying plate, and an adjustable break is applied to each of these pulleys, to strain or stretch the strands. A cable of  $\frac{3}{4}$  inch finished diameter has two layers of sixteen hempen strands each, and each strand is laid on under a strain of 8 lbs. In front of the two serving machines, and driven by a separate band, stands the sheathing machine. The copper or brass strips are wound on bobbins, as in the usual serving machines, and are drawn off from the bobbins to certain guides, of peculiar form, close to the served core. These guides lead the several strips, so that each strip laps over the preceding one by about one-third of its breadth. The core is supported and compressed by a tightening nozzle, up to the very spot at which the metal strips are laid on. The nozzle is made up of segments, contracted by an adjusting screwed nut. The strips laid on, lapping over one another, would form a cone instead of a cylinder, if it were not for a series of rollers, between which the metal-sheathed cable is immediately passed. These rollers forcibly compress the metal sheathing into a cylindrical shape; and a simple adjustment regulates the pressure exerted by all the rollers, by means of circular inclined surfaces pressing upon the ends of the slides that carry the rollers, which are all adjusted simultaneously by a hand-wheel. The result of the manufacture is certainly a cable very beautiful in appearance; but its practical value can only be decided by experience.

In reference to the defects of the usual iron wire sheathing, it may be observed, that some misconceptions have existed upon the subject. It seems to be generally supposed that wires, laid on spirally round a soft core, must, as soon as any strain comes upon them, stretch somewhat in the way that a spiral spring does; and many attempts have been made to obviate this supposed defect: but, on actual trial, no defect is observed. The single open helix of a spring stretches by diminishing the diameter of the coil; but when a number of wires are laid up, touching one another, so as to form a solid ring or cylinder round a centre, as in a telegraph cable, the diameter of the ring cannot diminish, even though the centre of the cable is soft; and, consequently, the only stretching that occurs is due to the elongation of the iron itself, added to a very small constant due to the more perfect closing of the wires one against another. It appears, from experiment, that there is hardly any difference in elongation between a solid rod and a well laid up cable; and in strength, no difference whatever between the cable and the wire composing it. The core does not, as at present made, add sensibly to the strength of the cable; for its resistance to the extension of say one per cent., at which the cable breaks, is insensible compared with that of the iron wire sheathing.

The twist put into a cable by the usual mode of coiling it, when laid in a mass, as in the hold of a vessel, has also sometimes been misunderstood: a twist is, no doubt, put into the cable by the process of coiling, but this twist is as certainly taken out again when the cable is uncoiled, and is, therefore, of no importance.

The only inconvenience attending the spiral lay of the cable sheath-

ing, in the author's opinion, is first apparent when the cable is being paid out, without sufficient strain upon it to lay it taut along the bottom. Then, as the slack accumulates, the cable becomes virtually free at the bottom, while the parts near the surface of the sea have considerable weight to bear; and the cable, therefore, untwists, and throws itself over into a bight. The number of turns taken out of the cable, and of bights put into it along the bottom, depends simply on the amount of slack paid out. When the cable is again picked up, these bights draw tight into kinks, to the injury of the recovered cable; and this is the only practical inconvenience attending the usual spun cables. The amount of elongation consequent on the untwisting is quite insignificant; and, except for these kinks, telegraph cable, recovered after three years from 1500 fathoms depth, has been found just as good as when it was laid down.

The common iron-covered cable can be easily laid safely in depths not exceeding 1000 fathoms; but, beyond that depth, steel wire should be used for the sheathing, or the specific gravity of the cable diminished. Exposed hemp is not admissible, owing to the marine insects already mentioned, which are found at all depths.

The general result of all the facts that have been ascertained, with respect to submarine telegraph cables, may be said to be, that all the heavy cables have succeeded and all the light cables failed; and the present tendency is certainly to lay heavier and heavier cables, protected by some composition against rust. It must be remembered, however, that all the heavy cables, except that between Spezzia and Corsica, have been laid in shallow water, whereas the small cables have been used in deep water: but the facts by no means prove that some new form of light cable may not ultimately be successful in deep water. The shore end of the new cable about to be laid between Holland and England is a fine example of the heavy class of cables, weighing 19·6 tons per nautical mile: the iron wire sheathing is here made double, the core being covered with fifteen wires 0·220 inch diameter, which are served with hemp, and then covered with twelve strands of three 0·220 inch wires each: it is further to be covered with pitch and hemp.

In conclusion, the author remarked, that he had not attempted to produce a complete account of the various forms of submarine telegraph cables, nor to enter fully into the merits or demerits even of the one most usual type of cable; he had simply endeavoured to draw attention to those points in the different constructions which affect their practical value and durability, so as to bring the subject fairly before the meeting for discussion.

Mr. Jenkin exhibited a number of specimens of the various constructions of submarine telegraph cables described in the paper, contributed by the principal manufacturers, and specimens showing the mode of soldering the successive lengths of the copper conducting wire to one another, and of joining one length of strand to the next by a soldered scarf joint.

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THE paper next read was, "*On the double-cylinder expansive steam engine*," by Mr. WILLIAM POLE, of London.

THE greatest advances made in the improvement of the steam engine, as an economical means of obtaining motive power, have resulted from the application of the principle of expansion, the advantages of which are now well known and universally appreciated among engineers. This principle has hitherto been applied to the greatest advantage in engines with a single cylinder, used for pumping purposes, as in Cornwall. In these cases, the peculiar nature of the motion admits of the steam being cut off after a small fraction of the stroke has been passed over, and allowed to expand during the remainder. When, however, the principle of expansion is applied in this mode to engines for producing rotary motion, some difficulties arise, which limit considerably the extent that the expansion may be carried to, and therefore reduce in a corresponding degree the economy attained.

The double-cylinder engine offers a mode of applying the expansive principle to a rotary motion, which removes, or, at least greatly mitigates, the objections to the single cylinder: and it is the object of the present paper to state the nature of the advantages of the double-cylinder engine, to explain the principles on which they are based, and to show how these principles have been carried out in practice with satisfactory results.

The original invention of the double-cylinder engine is intimately connected with the discovery and first application of the principle of expansion itself; but the unfortunate disputes which for a long time prevailed in reference to this subject have somewhat obscured the history. Having had occasion, however, some years ago, to investigate the matter, the author believes the following account represents the facts as accurately as they can be ascertained.

The double-cylinder engine was invented by Jonathan Hornblower, a mechanical engineer of considerable eminence in Cornwall, who took an important part in the application of the steam engine in that district, during the early part of Watt's career. The idea appears to have occurred to him early in the year 1776, if not before. He experimented upon a large working model, the cylinders of which were 11 and 14 inches diameter respectively; and he published his invention in 1781, describing it as consisting in the employment of two steam cylinders,—the steam, after it had acted in the first cylinder, being employed a second time in the other, by permitting it to expand itself; the two cylinders being connected together by suitable steam ports and valves. At the same time, he described also, shortly but clearly, several other inventions relating to the steam engine. One referring to surface condensing, which is so much applied in modern days; others to means of getting rid of the air and condensed water; and another invention was a steam piston, which, altered into a steam stuffing-box, is in common use at the present time. Here, therefore, was clearly developed the theoretical principle, as well as the practical application of the expansion of steam; and it is beyond dispute, that the first publication of the principle to the world was this of Hornblower's. The discovery of this principle, however, is usually ascribed to Watt, on the strength of a letter written by him to his friend

Dr. Small, of Birmingham, as early as 1769,—twelve years before Hornblower published his description; in that letter, Watt gives a clear and explicit description of the general principle of expansion. Notwithstanding, however, the large practice Watt had about this time, it does not appear that he ever applied expansion with any view to economy in its use till 1776, when an engine at the Soho works was altered to work expansively. In 1778, another engine, at Shadwell, was experimented upon; and Watt published his invention with reference to expansion in 1782, eight months after the publication of Hornblower's. The over-zealous friends of Watt, who, in a spirit so contrary to that of the great man himself, have sought to exalt his fame at the expense of another's, have charged Hornblower with pirating the principle, from surreptitious information of Watt's experiments; but no proof was ever given of the accusation. It is not only highly improbable in itself, but is altogether negatived by the fact that the originality of the invention on Hornblower's part was expressly admitted by Watt himself. It may therefore be concluded that the discovery of the expansive use of steam—one of the most important and valuable principles in the whole range of practical science—was original both with Watt and Hornblower; and, although Watt has established the priority of the idea, the first publication of it to the world was made by Hornblower in the double-cylinder engine.

After some years' delay, Hornblower proceeded to manufacture his engines in Cornwall; and the miners, perceiving that the double-cylinder engine acted tolerably well, took advantage of it somewhat largely; and in some cases endeavoured to make it supersede Watt's single-cylinder expansive engine, which had also then been brought extensively into use. But as it was impossible to make Hornblower's engine work well, without using Watt's separate condenser, invented in 1769, the competition could not be kept up, and the double-cylinder engine consequently for a time fell into disuse.

Both Watt and Hornblower had failed to perceive that, to work the principle of expansion to its full advantage, it was necessary that the steam should be admitted to the cylinder, in the first instance, at considerable pressure. Down to the year 1814, the pressure of the steam in the Cornish engines never much exceeded that of the atmosphere; and so little economy resulted in practice from the application of expansion with this initial pressure, that it was found scarcely worth using at all; indeed, after Watt's immediate connection with the district ceased, expansion was rapidly becoming disused and forgotten. The merit of rescuing it from this neglect belongs to two Cornish men—Richard Trevithick and Arthur Woolf—who, both about the same time, introduced into their native district the true means of advantageous expansion, namely, the use of high pressure steam. Trevithick applied this to Watt's single-cylinder engine; Woolf applied it to Hornblower's double-cylinder engine. The two forms of engine thus for the second time became rivals, and competed well with each other for many years; but it is only with Woolf's modification that the author is now concerned.

Woolf published his invention in 1804, while residing in London. It consisted simply in the application of high-pressure steam to Hornblower's double-cylinder engine, which he also made double-acting, to

fit it for rotary motion, after the example set by Watt long before. It is obvious, therefore, that the name "Woolf's engine," by which it is so often designated, is quite erroneous. The engine is entirely and solely Hornblower's invention, and there is no more ground for calling it Woolf's than for calling the present Cornish engine Trevithick's; for Trevithick made the same change with this latter engine that Woolf did with the former, yet no one would, on that account, think of disconnecting Watt's name from his own engine; and on the same ground Hornblower ought not to be deprived of the credit which the association of his name with his own invention should secure to him. Woolf's ideas respecting the laws of the expansion of high-pressure steam were very crude, and it is difficult to conceive how a man of such excellent practical knowledge could have deluded himself into the belief of theories so palpably absurd as those he laid down, upon which he based his statements as to the proposed advantage to be derived from the use of high-pressure steam. But, although he was so essentially in error on points of theory, he was not wrong in foretelling that much advantage might ultimately be gained by the use he proposed to make of high-pressure steam; as was proved beyond a doubt when his engines came to be fairly tried. His strong point was, skill in mechanical detail; and his improvements of the engine in this respect were almost innumerable, for there was scarcely a single part which did not receive some beneficial alteration at his hands. Woolf's first engine was erected in 1806 at Meux's brewery, in London, to which establishment he was engineer, and subsequently others were fixed in various manufactories; but these did little more than serve him as experiments, until 1818, when he returned to reside in Cornwall. Here he found a wide field open for his improvements; he entered in earnest into the manufacture of the engines, and they were highly successful. The new doctrine of high-pressure steam produced quite a revolution in the consumption of fuel there; for he at once raised the duty from about 20 millions, at which Watt had left it (that is, 20 million lbs. raised one foot high with the consumption of one bushel, or 94 lbs. of coal), to between 50 and 60 millions, thereby saving two-thirds of the fuel employed.

But though Woolf was so successful, the Cornish engineers shortly began to see that Trevithick's plan of using high-pressure steam expansively in the single-cylinder engine promised equally good results with Woolf's, and at the same time got rid of the objectionable complexity of the double cylinder arrangement. Trials on a large scale, in which even Woolf himself was persuaded to assist, soon demonstrated this to be true. The more expensive construction began to be abandoned in the mines, and the Cornish engine gradually settled down into its simplest form, namely, a single engine on Boulton and Watt's construction, but with Trevithick's high-pressure steam and high-pressure boiler; which form it has retained to the present day. Thus, although the double-cylinder engine was the first in which the principle of expansion was originally introduced to the world, and about thirty years afterwards was also the first in which this principle was made effective and advantageous, yet, in both cases, it was ultimately superseded by the more simple form of engine.

It remains now to give some account of the third era of prominence



attained by the double-cylinder engine, in its revival at the present day. In this revival many modern engineers have aided; but the author considers it the safest course to confine himself to the statement of his own experience, leaving it to others to give an account of what they may have done.

In 1848 the Lambeth Water-works Company, on the advice of their engineer, Mr. James Simpson, took the bold measure of proposing to remove their source of supply to the bank of the Thames at Long Ditton, above the tide way; and, as a part of this scheme, it became necessary to force the water, by steam-pumping power, along a cast-iron main, 9 miles long and 30 inches diameter, from the source to the reservoirs at Brixton Hill. This problem was a difficult one, no experience on so great a length of large main having then been obtained. The great mass of water in motion along the main, combined with the fragile nature of the cast iron, rendered it essential that the motion should go on in the most equable manner, and that concussions or irregularities of pressure should be as much as possible avoided, otherwise frequent fracture of the pipes, fraught with serious consequences to the district they passed through, might be looked upon as almost certain. At the same time, from the large steam power required, it became necessary that all possible improvements in regard to economy of fuel should be adopted. At that time the Cornish single-cylinder expansive engine, which had been introduced into London by Mr. Wicksteed, had been somewhat extensively tried for waterworks' purposes, and had justified its well-known Cornish reputation for economy; but as grave objections appeared to present themselves to its use in this case, on account of the irregularity of the single action, it was determined to ascertain whether the other form of expansive engine, the double cylinder, would not prove more applicable; and since the importance of the case required the most careful consideration, the author was commissioned, in conjunction with Mr. David Thomson, to investigate the subject generally, with a view to the advantageous attainment of the desired economy.

In commencing this investigation it was found that the double-cylinder engine had already been to some extent revived, and that modern examples of it, some of considerable size, were working in various parts of the country. These were visited, and their action carefully examined; but it did not satisfactorily appear that any engines then met with were sufficiently favourable instances of the application of the expansive principle. The expansion had not been carried to a sufficient extent to produce great economy, nor arranged in the best manner to attain equality of motion; and the arrangement of the valves and passages was generally so defective as to cause great loss of power and waste of fuel. Notwithstanding these unfavourable results, however, an attentive study of the principles of the engine led to the conclusion that, with a well-considered design carefully carried out into practice, the double-cylinder arrangement promised not only to be eminently suited to the case in question, but also generally to offer a more beneficial application of the principle of expansion to engines for rotary motion than could be attained with a single cylinder. In accordance with these views, when the Lambeth Water-works' *Extension* scheme was carried into effect, four large double-cylinder

engines were designed of 600 total horse power, the working of which has fully justified the expectations entertained of their advantages; their use has been speedily and largely extended to other cases; and the soundness of the principles on which they were constructed may now be said to have been fully proved.

The general theory of the double-cylinder engine is so well known, that it is unnecessary to repeat it here: the author proposes, therefore, to confine his remarks to such points as are of interest and importance in elucidating the advantages of this form of engine.

In the first place, in comparing the double with the single cylinder engine, it is a mistake to suppose that there is any theoretical advantage on either the one side or the other, in regard to the economical effect of the expansion. It was shown by Watt, in an ingenious way, at a very early period, and it is demonstrated in an appendix to this paper, that theoretically, if the steam be expanded to the same extent, the economical advantage to be derived from the expansion will be precisely the same, whichever form of engine be adopted for the application. And it further results from the principles of the engine, that, for a given initial pressure of steam and a given degree of expansion, the power of the engine, measured by the work it will do in each stroke, depends on the size of the large cylinder only, and is precisely the same as that produced in a single expansive cylinder of the same content. The small cylinder has no effect in adding power, but is merely an appendage, useful only for modifying the arrangement of the expansion and equalising the steam's action during the stroke.

The important objection, however, against carrying expansion to any great extent in a single cylinder for rotary motion, is the great irregularity of pressure at different parts of the stroke. For example, if the steam be expanded in a single cylinder to six times its original volume, by cutting it off when one-sixth of the stroke has been passed over, the motive force acting on the piston will be six times as great at the commencement of the stroke as at the end.

It is evident that the effect of the great excess of pressure will be to give a heavy blow to the piston at the beginning of every stroke, which must produce violent concussions through the whole of the machinery, and tend to produce much mischief and inconvenience in the working. In proportion as a greater degree of expansion is used, the evil will be greater. For example, if ten times expansion be used, the force of the blow at the commencement will be 803, while the mean pressure in the cylinder is still only 100, as before. For this reason, in single-cylinder engines it has been found difficult to carry the degree of expansion, and the consequent economy, to the same extent with the rotary as with the single-acting pumping engines. In the latter, the piston and all its connections are free to move under the action of the steam pressure; and therefore the excess of pressure at the commencement of the stroke is at once absorbed in giving velocity to the mass, and does no further harm. But in a rotary engine, the piston being controlled in its motion by the crank and fly-wheel, resists the violent impact, which occurs at the point when it is least able to give way; and the consequence must inevitably be a violent strain, repeated many times every minute, which must ultimately have a prejudicial effect upon the machinery. The advantage of the double-cylinder engine is,

that it mitigates this evil; for when its principles are properly understood and applied, it enables the economical benefit of a high degree of expansion to be obtained with much less irregularity of pressure than in the single cylinder.

In the original double-cylinder engines of Hornblower and Woolf, the steam was allowed to act first in the small cylinder, at full pressure, throughout the whole of its length, and then to expand into the larger one; the proportionate cubic content of the two cylinders thus defining the degree of expansion made use of: and, it is believed, that this method of working was that most commonly used down to the time of the investigations already referred to in 1848. But an enquiry into the principles of action of the engine, shows that it is most advisable not to allow the steam to enter the small cylinder during the whole stroke, but to cut it off after a certain portion of the stroke has been passed over, and to allow the expansion to commence at that point. And it is an important fact, which the author believes not to have been known until published by himself and Mr. Thomson, in 1851, that there is a certain point of the stroke, depending on the degree of expansion made use of, at which it is more advantageous to cut off the steam than at any other; for the reason that the irregularity in the motive power, which it is so desirable to mitigate, is then reduced to a minimum.

For example, if the mean motive power of the engine be represented by 100, and the extent of expansion adopted be six times, then, in a single-cylinder engine, the initial blow on the piston at the commencement of the stroke, as previously stated, will be represented by 215. In a double-cylinder engine, if the steam is allowed to enter during the whole of the stroke of the small cylinder, the initial blow will be the same in amount as in the single-cylinder engine, namely, 215; the duration of the blow, however, is only momentary, as compared with the first example, where it continues through one-sixth of the stroke. But if the steam is cut off in the small cylinder at 41 per cent. of the stroke, the initial blow is reduced to only 140: and this is the minimum blow that can be obtained with the expansion of six times; for on cutting off earlier, at 25 per cent. of the stroke, the initial blow is increased again to 161.

It thus appears that, as regards a degree of expansion of six times, if this expansion be effected in a single cylinder, the machinery of the engine will have to bear a sudden blow at the commencement of the stroke, as much as 115 per cent. greater than the mean force due to the effective power of the engine. Next, if a double-cylinder engine be employed, and the steam be allowed to enter during the whole stroke of the small cylinder, but little improvement is effected: the blow at the commencement is as great as in the single cylinder, only lasting a shorter time. But if the same engine be so arranged that the steam is cut off in the small cylinder at the proper point of the stroke, the initial blow may be reduced from 115 per cent. to only 40 per cent. in excess of the mean force; and thus a real and most beneficial improvement may be effected in the action of the engine. This most advantageous point of the stroke for cutting off, the author determined by calculation, in an appendix to his paper, which showed that it varies *with the extent* of expansion adopted in the engine.

The following Table shows the best point of cut off under various degrees of expansion, with corresponding results in the double cylinder and single cylinder engines. The first column gives the number of times the steam is to be expanded; the second shows the per-centage of the stroke at which the steam will best be cut off in the small cylinder; the third, the corresponding proportionate area of the small cylinder in per-centage of the large one, the length of stroke being the same in both; and the two last columns show the comparative advantage of the double over the single cylinder engine, in respect to the excess of the initial blow over the mean motive force. The calculation of these results is explained in detail in the appendix.

*Table, showing Best Point of Cut Off in double-cylinder engine with different degrees of expansion, and Comparative Initial Blow in double and single cylinder engines.*

| Number of times steam is expanded. | Best Point of Cut off in small cylinder. Percentage of stroke. | Capacity of small cylinder in percentage of large cylinder. | Comparative Initial Blow, the mean motive force being 100. |                         |
|------------------------------------|----------------------------------------------------------------|-------------------------------------------------------------|------------------------------------------------------------|-------------------------|
|                                    |                                                                |                                                             | Double cylinder engine.                                    | Single cylinder engine. |
| 4 times                            | Per cent. 50                                                   | Per cent. 50                                                | 126                                                        | 168                     |
| 6 times                            | 41                                                             | 41                                                          | 140                                                        | 215                     |
| 8 times                            | 35                                                             | 35                                                          | 151                                                        | 260                     |
| 10 times                           | 32                                                             | 32                                                          | 161                                                        | 303                     |

A comparison of the two last columns shows that, for a high degree of expansion, such as eight or ten times, the excess of the initial blow over the mean force of 100 is less than one-third as great in the double cylinder as in the single cylinder engine. It is clear, that the amount of this initial blow is the maximum strain on the whole of the machinery, by which the steam power is transmitted from the piston to the fly wheel, and it, consequently, determines the strength of the various parts necessary to resist this strain. Hence, in proportion as the initial blow can be reduced, all these moving parts are required to be less massive in construction; and all are subject to much less violent causes of fracture and derangement in their working.

Another point of improvement, to which the attention of the author and Mr. Thomson was prominently directed, was the arrangement of the valves and steam passages in the double-cylinder engine. In the engines they had the opportunity of examining, the system of valves commonly used was not only complicated, inconvenient, and expensive in construction, but also wasteful in action; the great size and disadvantageous arrangements of the passages caused considerable waste of steam, and consequent loss of power and fuel. There is a peculiarity in the double-cylinder engine, in its requiring a pipe or passage of some kind, through which the steam must travel, from one end of the small cylinder to the opposite end of the large one; and this passage should evidently be as small in content as possible, consistently with allowing the free passage of the steam. When the communication is opened

at the end of the stroke, the steam, passing from the small cylinder, has to expand and fill this passage before it enters the large cylinder; and if the passage be large, the steam must necessarily suffer a reduction of pressure in so doing, which must seriously diminish its effective action on the large piston during the future stroke, and so cause much loss. In some engines, the author found this loss so great as to waste nearly half the power of the engine; and even in the best that were examined, such a considerable per-centage of loss occurred, as almost to neutralize the benefit of expansion altogether.

Much attention was therefore given to this point in designing the new engines; and it was found essential to the success of the engines that some arrangement of valves should be adopted which should satisfy the following conditions: first, that they should be of the simplest possible character, and free from liability to derangement; second, that they should admit of the steam being cut off from the small cylinder at such a point as might be necessary to secure the required regularity in the motive power of the engine; and, third, that they should give the clearance spaces the smallest content possible, and, in particular, should allow the passage between the two cylinders to be direct and unimpeded, and of no larger capacity than was absolutely necessary for the passage of the steam. It was further found conducive to economy that the passage between the two cylinders should, if possible, never be opened either to the high-pressure steam or to the condenser, and should, moreover, be carefully protected from cooling.

A construction of valve was accordingly introduced which combined all these conditions, and was found in its practical working to be very satisfactory. The detailed description of this valve will be given in the succeeding paper by Mr. Thomson.

## LONDON ASSOCIATION OF FOREMEN ENGINEERS.

4th July, 1863.

MR. JOSEPH NEWTON, ROYAL MINT, IN THE CHAIR.

MR. W. MUIR, of Woolwich Arsenal, read a paper, "*On forgings in iron*," of which the following is an abstract.

THE speaker prefaced his remarks by observing that the subject of which he was to treat was one of acknowledged importance to the engineering profession. It had not, however, met with that amount of notice to which it was entitled. Too much stress was laid upon the finishing off of forgings, and not enough upon their actual production. If he could, in any way, supplement the deficiency in this respect, or even induce others to take up the subject, his purpose would be served. So varied were the kinds of forging required for the service of modern mechanical engineering, that it would be impossible to touch, in a single paper, upon even a moiety of them.

It was true of all, however, that, in order to ensure success, good material must be employed. Whether the tilt, the steam hammer, or

the hydrostatic forging machine were the medium used in the manufacture of a forging, this fact remained the same. In faggoting up from slabs, it was desirable that the thinnest slabs should invariably be placed in the heart of the faggot: this would ensure that the heat applied should permeate the mass more equally and uniformly. It was known, to those versed in such matters, that, as a rule, the outside surface of a faggot became hot sooner than the centre, and this led to unsoundness and other evils. The proper construction and management of the furnace constituted influential elements in the successful production of a forging, and a good furnaceman was a treasure of which the value could scarcely be overrated.

There were some descriptions of forged work which demanded more care and caution in their treatment than others. Those forgings, for example, which had to be provided with collars or projections were of this character. It was of great consequence, in such cases, that a sufficient quantity of stuff should be, in the first instance, taken down, for the purpose of finishing off. The points for the projections should be set out with accuracy. If the distance between them was found to be too short, there was the danger, in drawing them, of reducing the body of the forging so much that it would not afterwards turn up to size. If, on the other hand, the projections were placed too far apart, the upsetting, or staving up process, which that error entailed, was fraught with yet greater disadvantages—the grain of the iron would be deranged, and the forging consequently weakened.

Large shafts, such as propeller shafts for instance, which had to be coupled by means of collars or flanges, were forged with extreme difficulty. They frequently proved unsound. He had sometimes seen, in the very heart of the collars of such shafts, chasms or clefts, in which a folded two-foot rule might be concealed. Mr. Muir thought, that if those collars had been forged square and rounded off afterwards, instead of being rounded under the hammer, the chances of obtaining sound and solid work would have been largely increased. This position was not merely theoretical—he was fortified in it by practical experience. He had himself been entrusted with the production of some propeller shafts, the flanges of which were to be thirty inches in diameter. It had been permitted him to carry his peculiar views, in regard to square flanges, into effect. The result was very satisfactory. The flanges were forged square, and at four heats subsequently, the four corners of each flange were removed. The cost of the operation was somewhat greater than would have been the ordinary one, but that, he held, was a small consideration, in comparison with its greater certainty. He was strongly impressed by the belief that a round flange could scarcely be made perfectly solid, whilst a square one would rarely prove hollow. It was his impression, moreover, that the great difficulty which had hitherto been encountered, in the production of sound, heavy, malleable iron guns, would be disposed of, were they forged square and rounded off afterwards. At all events, he considered that such an experiment was worth a trial.

He had already spoken of the quality of the iron to be used in forgings, but he might be pardoned for reverting to that part of his subject. Many important forgings had been sadly deteriorated, and in some instances they had been sacrificed entirely by neglecting to make

a judicious selection of metal at the outset. Great care was necessary in assorting the irons for each faggot, so as to insure the complete amalgamation under the hammer. It was not easy to lay down definite rules in reference to the selection of irons. Practice and some amount of metallurgical knowledge were essential to the performance of this duty; and at present the reader of the paper would only insist upon the vital consequence of its being attended to. It was a *sine quâ non*, and the penalty for neglecting it would be heavy indeed.

When a forging was required to be "taken down," the work should be accomplished by the use of carefully-prepared tools, well rounded "setts," &c., &c., so as to leave gussets or fillets, which might afterwards be readily turned off. The grain of the iron would thus be preserved intact, and the strength of the forging enhanced. It was desirable, too, to put, in all cases, the last wrought heat after planishing or swaging into the furnace. By bringing the forging, then, to a low red-head, the consistency of its surface would be equalized, and the annealing, so to speak, would have the effect of revealing the fact, if it were a fact, of undue hammering having been administered in particular parts of the work. In such case a tendency to bending, the result of unequal expansion, would manifest itself, and straightening might be resorted to.

Whatever the nature of the piece of work in hand, no more of it should be made hot, or at least, no more of it should be brought to a welding heat, than was to be dealt with at once. Repeated heatings were weakening in the last degree, and the iron submitted to such an ordeal became crystallized and brittle. Then, again, in piecing or lengthening a shaft or other forging of magnitude, and when lays were used for the purpose, the scarfs of those lays should be left of sufficient thickness at the points. If they were thinned down too much, they cooled too rapidly in their transit from the furnace to the anvil. The consequence would be that another heat was required, and a similar result might follow. The union at last might be accomplished, but still there was the risk of not holding up to finished size. The evil and risk would be avoided by leaving the scarf of the lay of an adequate thickness to withstand the action of the air until the piecing was effected.

Mr. Muir next proceeded to speak of the forms and dimensions of furnaces and furnace chimneys. The most remarkable statement in connection with this part of his subject was that in reference to the interior proportions of chimneys. Instead of tapering the orifice in the ordinary way, the speaker would reverse the rule, and would make it wider at the summit than the base: at least, the smoke way should be parallel, and not tapering upwards.

Forgings for machinery should be produced of sufficient size to turn up to the required finished dimensions, but never too large for that purpose, because the rind or best part of the iron would be removed in the lathe if this were so. A trustworthy and conscientious body of forgers, too, was a desideratum; these would detect and point out, at the earliest stage in the progress of a forging, any flaw or doubtful part which might exist in it. It was impossible for foremen engineers to be ubiquitous, or to possess the eyes of Argus. They must trust to some extent to workmen under them, and these might conceal

defects, in order to conceal also their own neglect. Life and property depended often on the faithful performance of the forgers' duty, for a weak point in their workmanship would not unfrequently degenerate into a break-down at a critical moment.

In concluding his paper, Mr. Muir made some remarks upon the peculiar labours of the ship-smith, and on the morality of the work-shop generally.

A discussion on the paper was shared in by Messrs. Oubridge, Secombe, Stabler, Stanley, Ives, and the President.

### JUDICIAL COMMITTEE OF THE PRIVY COUNCIL.

*Present—The Lords Justices Knight Bruce and Turner, and Sir John T. Coleridge.*

July 2nd to the 7th, 1863.

THIS was an application for an extension of a patent granted to Mr. Frank Clark Hills, for "an improved mode of compressing peat for making fuel or gas, and of manufacturing gas, and of obtaining certain substances applicable to purifying the same," bearing date November 28th, 1849. The application was supported by Sir Fitzroy Kelly, Q.C., Mr. Grove, Q.C., and Mr. Hindmarch, Q.C., and opposed by certain gas companies and individuals interested in gas purification.

In opposition to the application, Mr. Bovill, Q.C., and Mr. Webster represented the Central Gas Consumers' Company; Sir Hugh Cairns, Q.C., the South Metropolitan Company; the Hon. Mr. Denman, Q.C., appeared on behalf of Mr. John Frederick Evans, a patentee of gas purifying material; and Mr. Druce represented Mr. Dawber, who claimed to be the discoverer of the material known as bog ochre.

The invention forming the subject of this application may be described as consisting in the use of hydrated oxide of iron, for the extraction of sulphuretted hydrogen from coal gas, and the subsequent revivification of the spent material (when saturated with sulphur) by exposure to the air. It would appear that, at an early period of the patent, Mr. Hills was involved in law, in the first place to make good his claims, and subsequently to maintain his rights. He first came into collision with Messrs. Owen, Mertens, and Laming, who were engaged in the manufacture of ammonia from gas liquor, and who were the owners of a patent granted to Mr. Laming in the year 1847, in which it was alleged that the precipitated or hydrated oxide of iron, claimed by Hills, was disclosed (under the term carbonate of iron). After considerable litigation with these gentlemen, and the repeal, by writ of *scire facias*, of a patent granted jointly to Mr. Laming and Mr. Evans, for further improvements in gas purifying, a compromise was entered into, and mutual licenses exchanged; but Messrs. Laming and Evans still claimed to be the inventors of Mr. Hills's patented improvements, they having used them at the works of the Chartered Gas Company, of which Mr. Evans is engineer, in the year 1849. In 1853, Mr. Hills entered a disclaimer to much extraneous and useless matter in his specification; and in 1856, he made a further emendation, narrowing his claims to the improvements in gas purifying above described. This was preparatory to the commencement of a course of litigation



with gas companies, which continued down to the beginning of the present year.

The first company sued was the London Gas Light Company, the action for infringing the patent being tried before Chief Baron Pollock, at Westminster, and ending in a non-suit; the learned judge considering that the use of the hydrated oxide was anticipated by Laming's patent of 1847. On an appeal, a rule was granted for a new trial; and, in the meanwhile, Mr. Hills, in the spring of 1848, sued the Equitable Company, in the Court of Queen's Bench; but Lord Campbell hearing that the new trial was still pending, refused to hear the case, and advised the plaintiff to try his case at Guildford Assizes. At the Guildford trial, which lasted five days, a verdict was obtained by the plaintiff, and the whole course of law proceedings which followed this decision was, in substance, invariably in favour of Mr. Hills. An application was made to set aside the verdict of the Guildford jury, but the application, after a discussion of many days, was refused. The defendants then appealed to the Court of Exchequer Chamber, with the same result; and an appeal to the House of Lords was only stopped by a compromise between the litigants. Mr. Hills next applied to the Court of Chancery, and obtained from Sir Page Wood an injunction to restrain the Brentford Gas Light Company from the use of the invention. The defendants then carried the case to the Appellate Court, and the judges there disagreeing, it came before the Lord Chancellor, who, after hearing the case discussed for five days, decided as above intimated, in favour of the plaintiff, thereby stopping the use of an artificially prepared oxide of iron, forming the subject of Mr. J. F. Evans's patent of August 27th, 1858, which material, up to that time, was not considered to be embraced by Mr. Hills's patent. The opinion elicited from the Lord Chancellor having apparently opened a way to the safe use of another material equivalent to the plaintiff's hydrated oxide of iron artificially prepared—viz., a natural product known as bog ochre—this was also deemed by the plaintiff an infringement, and was brought under the consideration of the Lord Chancellor, who decided that, although the use of the bog ochre, a natural hydrated oxide of iron, was no infringement, yet the revivifying of the spent material, by exposing it to the action of atmospheric air, brought it under the term of an artificially prepared purifying material. As, therefore, the ochre could not be re-used without infringing the patent, the plaintiff had at last brought the whole trade under his feet.

In consequence of all this litigation, it was alleged that this most important discovery—the value of which was proved by the obstinate nature of the contest to secure its use—had brought a very inadequate remuneration to the patentee, whose estimated profits would, at the expiration of the patent, realize £16,942, including his manufacturing profit; but if he had not entered into the manufacture of the purifying material, but had contented himself with remuneration from royalties only, then the profits would be reduced to £4696, a sum bearing no comparison with the pecuniary advantage accruing to the public; the saving to the gas companies, supposing (as some had estimated) the consumption of coals in gas-making to amount to six million tons annually, being at the rate of £150,000 per annum.

*It appeared that Mr. Hills had two other patents,—one for supplying*

currents of air to the spent purifying material, for the purpose of revivifying it, dated 1852, and the other for extracting and utilizing the sulphur contained in the spent material, by converting it into sulphuric acid. The former of these patents Mr. Hills had forced upon his licensees, compelling them to pay for its use, whether employed or not; and it was contended that the money realized by this patent, which was in itself of no value, must be thrown into the account of the patent of 1849. In like manner, as the spent material furnished Mr. Hills with sulphur for manufacturing sulphuric acid—and he had a monopoly of this spent material—the value of the sulphur, which really cost him nothing to extract, must also be added to the patentee's profit. With these additions, and by striking out certain inadmissible offsets, it was contended that Mr. Hills's profits showed an excess of £100,000. And with respect to the degree of merit which he could claim, it was further contended to be very little, if any. The use of oxide of iron was disclosed in Heard's patent of 1806; again, by Croll's patent of 1840; and also by Laming's patent of 1847. Then, as to the revivifying, which had been practised before the date of Hills's patent, by Laming and Evans, at the works of the Chartered Gas Company,—although, as it was considered by the Guildford jury, only experimentally, that was included in a French patent obtained by Laming, bearing prior date to Hills's patent. Besides which, although the mode of purifying gas according to Hills's patent was undoubtedly extensively practised, to the great benefit of the public, its pecuniary value was due solely to the compulsory disuse of lime as a purifier, and not to the more efficient action of hydrated oxide of iron. In localities where lime could still be legally used, its use was continued; but in large towns, where the residuum could not readily be disposed of, a virtual prohibition existed. So long, therefore, as lime was allowed to be used, the well-known merits of oxide of iron were not brought into requisition. It was further contended, that by Section XXV. of the Patent Act of 1852, a renewal of Mr. Hills's patent would be of no avail, as it must of necessity lapse with Mr. Laming's French patent. On behalf of Mr. Evans and Mr. Dawber, it was urged that the extension of the patent would be a bar to the use of their several discoveries, viz., the use of oxidized granulated iron, and of bog ochre, which had indirectly been, by decisions of the Court of Chancery, brought within the scope of Hills's specification; although, by their use, the public would secure important advantages. On all these grounds, therefore, the opponents to the prolongation trusted that their Lordships would dismiss the application.

On behalf of the Crown, Mr. Welby attended to watch the case; but considering their Lordships had been fully informed of everything belonging to the case, and which was necessary for forming a decision upon it, he took no active part therein.

Their Lordships having taken time to consider their decision, Lord Justice Turner delivered the following important

#### JUDGMENT.

THIS was an application for the prolongation of a patent granted on the 28th of November, 1849, for an "improved mode of compressing peat for making fuel or gas, and of manufacturing gas, or of obtaining certain substances applicable for purifying the same." It has been resisted by an unusual number

of opponents, and the several grounds of want of novelty, and want of utility, and of the patentee having had sufficient remuneration, are insisted on in the several notices of objection put in by the several opponents. Their Lordships, however, have not in these cases been in the habit of trying the validity of patents. They will not, of course, recommend the extension of a patent which is manifestly bad; but, on the other hand, they will not generally enter into questions of doubtful validity. They lay aside, therefore, the questions of want of novelty and want of utility, so far as they affect the validity of this patent. Indeed, the learned counsel for the opponents disclaimed, and very properly, any intention of impeaching its validity directly; but they contended that, both with respect to the novelty and the utility of the invention, the degree of merit to be attributed to the petitioner ought to be taken into account; and in their Lordships' judgment they are right in that contention. There are two points, therefore, of general application, material to be considered in this case, the *degree* of merit to be attributed to the petitioner in respect both of the novelty and utility of his invention, and the amount of remuneration received by him or secured to him. To these points, which are of general application, must be added a third, respecting a French patent, granted to one Richard Laming, for fifteen years, from the 22nd of February, 1849—earlier, therefore, than the petitioner's patent, and having still some months to run; and if this French patent be held to be for the same invention as the petitioner's, the power of prolongation would be, at all events, limited to so short a period that it would be clearly improper to exercise it. It may be convenient to say all which their lordships deem it necessary to say on this point, before proceeding to dispose of the other two.

As the patent now under consideration was granted before the passing of the 15th and 16th of Victoria, cap. 83, and as the French patent has not yet expired, this case does not fall strictly within the operation of the 25th section of the Act; but the policy which the Legislature there indicates must still guide their Lordships in the exercise of their discretion. That policy is clear—to prevent, in the case of inventions made and patented in any foreign country, the continuance of a monopoly in this country by virtue of any patent subsequently granted here, beyond the time when the discovery shall have become public property in the foreign country. Prolongation of an existing patent must, of course, fall within the same rule. If, therefore, it were clear that the discoveries of Hills and Laming were the same, however independently made, and that of Laming were about, within a few months, to become the property of the public by efflux of time, their lordships would certainly think it wrong to recommend a prolongation of the monopoly in this country. Upon a careful examination, however, of the two specifications, and a consideration of the conflicting evidence upon the subject, and recollecting how this question has been dealt with in the courts of law and equity before which it has come, their lordships do not feel so free from doubt as to warrant them in rejecting the petitioner's application on this ground alone, more especially as they are not satisfied that any previous knowledge of Laming's experiments is brought home to the petitioner. It cannot be doubted, however, that these two discoveries approach very closely to each other; and although their lordships do not decide this case on the ground of this objection alone, it is not to be understood that, in another part of the inquiry, it has had no weight in the conclusion at which they have arrived on the whole case.

Their lordships now pass to the first of the two questions stated above. It may be collected from what has been already said, that in determining whether to recommend the prolongation of a patent or not, even where the claim to a first discovery, and the beneficial nature of that discovery, are both conceded, it will be still proper to consider both the degree of merit as inventor, and the amount of benefit to the public flowing directly from the invention. A monopoly limited to a certain time is properly the reward which the law assigns to the *patentee* for the invention and disclosure to the public of his mode of proceed-

ing. Whether that term shall be extended, in effect, whether a second patent shall be granted for the same consideration, and the enjoyment by the public of its vested right be postponed, is to depend on the exercise of a discretion, judicial indeed, yet to be influenced by every such circumstance as would properly weigh on a sensible and considerate person in determining whether an extraordinary privilege, not of strict right, but rather of equitable reward, should be conferred. Now, one may be strictly an inventor within the legal meaning of the term—no one before him may have made and disclosed the discovery in all its terms, as described in his specification—but this may have been the successful result of long and patent labour, and of great and unaided ingenuity, without which, for all that appears, the public would never have had the benefit of the discovery; or it may have been but a happy accident, or a fortunate guess; or it may have been very closely led up to by earlier, and, in a true sense, more meritorious, but still incomplete, experiments. Different degrees of merit must surely be attributed to an inventor under these different circumstances. The moral claim to an extension of time may in this way be indefinitely varied, according as the circumstances approach nearer to the one or the other of the above suppositions.

The same principle will apply to the consideration of benefit conferred upon the public. The extent of the benefit conferred must vary in each case with the circumstances. The principal question always is—has the individual patentee, under all the circumstances, received what in equity and good sense may be considered a sufficient remuneration? On his own part, of course, there must have been no want of good faith or prudent exertion; and further, as the loss to the public may be important in the consideration, it may be necessary, in some cases, not to confine the inquiry to the state of things at the date of the patent, but to regard also the circumstances existing at the time when the application is made. These principles may be collected from the previous decisions, and it has been thought right here to re-state them shortly as relevant to the present case, and as the points have often arisen, and will probably arise again in future cases.

Much evidence was laid before their lordships to reduce their estimate of the patentee's merit in respect of originality. Some earlier patents were introduced, and the greatest reliance was placed on the claims made on behalf of Mr. Laming and Mr. Evans. These two persons were in some measure opposed to each other; but it appeared to their lordships that, for the present purpose at least, their mutual objections might be sufficiently reconciled. It is not easy for those who are not chemists to state in detail, and with precision, the exact effect of the evidence; but after the best consideration, their lordships feel the case of Mr. Laming to be of great weight in the sense in which it is now to be applied.

In the interest of the public, the objection put forward by Mr. Dawber is also material. He states himself to be the inventor of a mode of purifying gas by the use of a natural oxide of iron, and this has been contended to be within the terms of the claim made by Mr. Hills in his specification; but certainly the use of natural oxides does not appear to have been contemplated by him, and Mr. Dawber might very reasonably have supposed himself at liberty to use them, and to contract, as he states himself to have done, for the supply of them to third parties. His material is the ochre found in certain bogs of Ireland, procurable at a comparatively cheap rate; it contains a native oxide of iron, which answers very well the purpose of purifying the gas of its sulphuretted hydrogen; possesses equally with Mr. Hills's material the quality of revivification on exposure to the air, and it also produces fine sulphur by a very simple process, when it has ceased to be useful as a purifier of gas. It is understood that Mr. Hills has insisted that this valuable discovery cannot be enjoyed by the public, except under a license from himself, so long as his patent exists. The result of the evidence offered on this head by the objectors, and especially in the two instances we have enlarged on, raises a considerable difficulty in the way of this petition.

But a more serious difficulty arises upon the remaining question—the sufficiency, namely, of remuneration already received by or secured to the patentee, the previous matters being borne in mind. After considerable variations in the accounts rendered, not quite satisfactorily explained, he finally states his net profits at £12,338. 19s. 1d., the gross profits being £41,151. 15s. 11d. How this last sum was arrived at does not very distinctly appear; but the deductions appear to be open to various objections. The Royalty receipts are given at £15,713. 9s. 8d., but from this a sum of £4250 is deducted, as having been paid to Owen and Co. for the surrender of a license which the patentee had granted to those gentlemen for the exclusive right to use the invention throughout a large part of England. Now, the profits under that license, as well as the sums paid for it, are of course profits earned by the patent, and ought to have been brought into the account as such. Whether they have been so or not does not appear, and it was the duty of the patentee to make that perfectly clear to their lordships. But further, they do not agree that he is entitled to take credit for a disbursement, the necessity for which he has himself occasioned. He had within his jurisdiction, so to say, the whole kingdom: it was either profitable or not to grant a license for a part, and thereby to put it out of his own immediate power, but it was his own act to do so; and if, after awhile, it appeared to be an unwise act, so as to make it desirable to undo it, even at a cost of £4250, this was either a loss which he brought on himself, or represents a profit which, but for his own election, he might himself have made, and which has been made by another party.

There is also a deduction of £9020. 12s. 8d. for law expenses. This is, in general, a fair head of deduction, nor is it now objectionable in the whole; but it appears that, in some expensive cases of litigation, settlements were come to under compromises, on which Mr. Hills gave up claims to costs to which he had an apparent title, from his adversaries. It may have been a prudent measure to make this sacrifice, but it does not follow that it is proper to deduct it in an unexplained lump.

A more serious objection still remains, on the ground of items withheld, which ought to have been introduced into the profits. Mr. Hills has turned his patent to account in two ways—first, as a manufacturer and vendor of the patented article; and, secondly, as a grantor of licenses to third persons, who pay him royalties. No question has been raised on the second head; but, as to the first, he deducts two-thirds, as manufacturer's profits, from the net profits received, and considers the remaining third as alone attributable to the patent, and therefore as alone to be brought into the present account; and this is objected to. Their lordships find that this committee laid down expressly a contrary rule in the case of Mr. Muntz's patent (*Webster's P.C.*, vol. ii, p. 121), and, as it seems to them, on clear grounds. It is to be remembered that the accounts which a patentee renders in support of such a petition as the present, are not such as might be proper between two several claimants on the returns of a mercantile firm, but such as show what profits, made by a firm or individual, are in a large sense attributable to the possession of the patent right—those which, without the patent, would not have existed at all; not, of course, excluding all just deductions for labour, capital, &c. If, but for the patent, there would have been no manufactory, then the net profits of the manufacturer are, in that large sense, attributable to the patent. With it the manufacturer has a monopoly—in this case, the monopoly of an article so beneficial as to have become almost a necessary to the gas companies in the large towns of the kingdom. The patent may be said to create his trade—at least, it develops it to an extent which would be impossible without it; it cannot be reasonable, then, that when called on to state what profits he owes to the patent, the patentee should withhold these, which he estimates at two-thirds of his total profits, from the account. Their lordships cannot satisfactorily discharge their duty unless they have the whole case before them; they must know the whole remuneration: different considerations may be applicable to different parts of it; but if, to any extent,

the patentee has received his remuneration by the making and selling the patented article, the profits on that sale must be disclosed and taken into account. Their lordships do not say that this principle is to be pushed to an unreasonable extreme, and they have said that they do not exclude all just deductions, if any; but this rule, and that for which the petitioner contended, differ in principle, and the rejection of the rule, contended for by the petitioner, will, no doubt, let in a considerable addition to the total which he has given.

It has further appeared that the petitioner has entered into contracts with certain gas companies, by which, as is contended, the parties are, for the considerations therein stated, mutually bound to the supply and purchase of the now patented article, for terms differing in the time they have to run, but all exceeding more or less considerably, the duration of the patent, and independently of its extension. Their lordships are not called on to decide on the legal effect of these contracts, nor to express any opinion as to their consistence with public policy: but they cannot consider them as merely waste paper. The prices agreed on must be taken to be remunerative. The presumption must be that the contracts will be performed, and the prices paid. Something, therefore, ought to have been set down for them in the accounts. Again, their lordships are by no means satisfied with the provisions contained in these agreements against opposing the extension of the patent. Such provisions have, to say the least, a strong tendency to contravene the interest of the public.

On all these grounds, their lordships think that the petitioner's application must be dismissed. The onus is upon him to satisfy them that, when all circumstances are considered, his remuneration has been less than he is equitably entitled to. No one but himself is in a condition to state the whole account, and it is important to have it distinctly understood that the most unreserved and clear statement is an indispensable condition to the success of such applications as the present. It might have been enough, and perhaps it would have been the safest and most convenient course, for their lordships to have said merely that they had not, in this case, been brought to the conclusion that the petitioner's remuneration has been insufficient; but they have thought it best to comment on the above particulars, and, without stating any sum which they should have thought less, or any which would have appeared to them more, than sufficient, their examination of those particulars has convinced them that the petitioner has in fact been sufficiently remunerated.

There remains, then, only the question of costs. The opposition has been necessarily very expensive. It has not been alleged, nor has it appeared, that any of the numerous opponents were without a sufficient interest to justify their appearance; and it would be unjust that the expense of a successful opposition should not be, to some extent, borne by the petitioner who has occasioned it. Their lordships think that he should pay a sum of £1000, according to a distribution to be made by the registrar amongst the parties opposing, without the expense and delay of a formal taxation, unless the Appellant prefers a taxation, in which case the petition will be dismissed with costs generally; and their lordships will advise Her Majesty accordingly.

### Provisional Protections Granted.

[Cases in which a Full Specification has been deposited.]

1536. Henri Adrien Bonneville, of Paris, impts. in machinery for the manufacture of bolts and rivets,—a communication.—*June 19th.*

1599. Daniel Hussey, of Nashua, New Hampshire, U.S.A., the invention having reference to bobbins and the

winding of roving or yarn thereon.—*June 25th.*

1643. George Tomlinson Bousfield, of Loughborough-park, Brixton, machine for preparing cotton wool or other fibrous material,—a communication.—*July 1st.*

1667. Henri Adrien Bonneville, of Paris, impd. machine constructed on self-moving principles, for obtaining motive power,—a communication.
1668. Henri Adrien Bonneville, of Paris, impts. in the manufacture of telegraphic wires, and in the apparatus connected therewith,—a communication.
- The above bear date July 4th.*
1690. George Potter Reed, of Massachusetts, U.S.A., impts. in watches or timekeepers.—*July 7th.*
1701. George Haseltine, of Southampton-buildings, impts. in lever horse-power machines; the cog gearing employed being applicable to other machines,—a communication.—*July 8th.*
1752. Henri Adrien Bonneville, of Paris, impts. in certain descriptions of breech-loading fire-arms,—a communication.—*July 13th.*
- [Cases in which a Provisional Specification has been deposited.]
448. George Tomlinson Bousfield, of Loughborough-park, Brixton, impts. in the manufacture of boots and shoes, and in preparing india-rubber for such and other uses,—a communication.—*February 18th.*
557. Arthur Dudgeon and George Frederick Lee Meakin, of Martin's-lane, Cannon-street, and Edward Ellis Allen, of Parliament-street, impts. in the construction of underground railways or subways, and in carriages to be used or worked therein.—*February 27th.*
626. Thomas Westwood Osborne, of Aston New Town, Warwickshire, impts. in lamps.—*March 5th.*
659. Henry Fletcher, of Manchester, impts. in cleaning and preparing cotton for spinning.
669. Andrew Barclay, of Kilmarnock, N.B., impts. in traction engines, and in apparatus for indicating the pressure of steam.
- The above bear date March 11th.*
758. John Muir Hetherington, of Manchester, impts. in machinery or apparatus for combing cotton and other fibrous materials.—*March 21st.*
997. William Ryan and William Daniel, of Dublin, impts. in apparatus for transmitting, equalising, and registering human power.—*April 21st.*
1002. Henry Bernoulli Barlow, of Manchester, impts. in shoes, boots, and other coverings for the feet,—a communication.—*April 22nd.*
1062. George Hall and Josiah Wells, of Worcester, a new explosive compound, applicable for all the purposes for which gunpowder is or may be used.
1067. John Henry Johnson, of Lincoln's-inn-fields, impts. in apparatus for preserving property in case of shipwreck,—a communication.
- The above bear date April 28th.*
1146. Charles Arthur Day, Andrew Lamb, and Thomas Summers, of Southampton, impts. in marine engines.—*May 7th.*
1157. Evariste Chamonin Boët, of Lille, impts. in tanning hides and skins,—a communication.—*May 8th.*
1180. Charles Louis Van Tenac, of Tredegar, a new wrought-iron railway sleeper,—a communication.
1181. Charles Louis Van Tenac, of Tredegar, armour plates of hammered or rolled wrought iron; the whole of the rivets being protected against the direct blows from the cannon shots.
1184. Joseph Severin Guirette, of Paris, impd. inhaling apparatus.
1185. James Shanks, of Arbroath, N.B., impts. in machinery for cutting or shearing the edges of grass or turf.
1186. James Edward McConnell, of Dean's-yard, Westminster, and George Hinton Bovill, of Durnsford Lodge, near Wandsworth, impts. in chains for cables and other purposes.
- The above bear date May 11th.*
1187. Benjamin Lilly, of Birmingham, impts. in the construction of "snap caps" or "nipple protectors" for fire-arms.
1188. William Mattison and George Barker, of Leeming Bar, near Bedale, Yorkshire, impts. in grass mowing and reaping machines.
1189. Thomas Warren, of Glasgow, impts. in glass and other furnaces or kilns.

1191. James Edward McConnell, of Deans-yard, Westminster, and George Hinton Bovill, of Durnsford Lodge, near Wandsworth, impts. in treating worn-out railway tyres.
1192. William Whiteley, of Lockwood, Yorkshire, impts. in looms for weaving.
1193. George Augustus Huddart, of Brynkir, Caernarvonshire, impd. apparatus for cutting slate.
1194. Horace Leeman Emery, of Sloane-street, impts. in apparatus for manufacturing saws, suitable for ginning cotton, and for other uses,—a communication.
1195. Richard Archibald Brooman, of Fleet-street, impts. in spring mattresses,—a communication.
1196. Richard Archibald Brooman, of Fleet-street, impts. in spring mattresses, sofas, chairs, seats, and similar articles,—a communication.
1197. Richard Archibald Brooman, of Fleet-street, impts. in machinery for preparing, dressing, and winding cotton, woollen, flax, silk, and other warps,—a communication.
- The above bear date May 12th.*
1198. Henry Rushton, of Northampton-road, Clerkenwell, impts. in head dresses.
1199. Richard Archibald Brooman, of Fleet-street, impts. in laying submarine telegraph cables,—a communication.
1200. Henry Wilde, of Manchester, impts. in electro-magnetic telegraphs.
1201. Thomas Parkinson and Francis Taylor, of Blackburn, impts. in machinery for weaving, sizing, dressing, and dyeing.
1202. Frederic Holthausen, of Paris, impd. portable copying press.
1203. James Edward McConnell, of Deans-yard, Westminster, and George Hinton Bovill, of Durnsford Lodge, near Wandsworth, impts. in the manufacture of thick plates of wrought iron for armour plates and other purposes.
1204. Victor Julien Cassaignes, of Paris, impts. in stereoscopes.
1205. Karl Ludwig Heusner, of East Greenwich, impts. in the manufacture of hydrate of barytes, and in the manufacture of sugar.
1206. Benjamin Lambert, of Lothian-road, Camberwell New-road, impts. in paper-makers' rag or pulp engines.
1207. Anthony Gapper Southby, of Bulford, Wiltshire, impts. in railway roof lamps, station, signal, and other fountain lamps.
1208. James Farmer, of Salford, impts. in calendering, embossing, and other such machines used for finishing woven fabrics; part of which impts. is also applicable to drying machines.
1209. Richard Archibald Brooman, of Fleet-street, impts. in the extraction of hydro-carburets from minerals, in the distillation thereof, and in apparatus employed therein,—a communication.
- The above bear date May 13th.*
1210. Thomas Lawrence, of Salford, impts. in machinery or apparatus used in the processes or operations of drying, dressing, brushing, waxing, and finishing fabrics.
1211. John Satchwell, William Henry Ashford, and Cornelius Harrison, of Birmingham, impts. in nails or rivets for boots and shoes, applicable to other purposes.
1212. Alexander Pilbeam, of Glasgow, impts. in sewing machines.
1213. John Thomson King, of Liverpool, impts. in wicks for oil and other fluid burning lamps,—a communication.
1214. James Burrell, of Back Church-lane, Whitechapel, impts. in the construction of cocks or valves.
1215. George Dowler, of Birmingham, impts. in match boxes.
1216. Lewis Scudder Chichester, of Brooklyn, U.S.A., impts. in machinery for weighing grain.
1217. Frederick Keate Erlam, of Devonshire-terrace, Fulham-road, a new lubricating material or compound.
1219. Isaac Parker, of Haughton-street, Clare-market, impts. in connecting and securing door and other knobs or handles to their spindles.
- The above bear date May 14th.*
1220. Benjamin Shillito and David Moore, of Kingston-upon-Hull, impts. in generating heat and motive power.
1221. Douglas Monro Fyfe, of Maiden-



- head, impts. in the brushes, instruments, or apparatus employed for painting the centres and bull's-eyes of military or other targets.
1222. Douglas Monro Fyfe, of Maidenhead, impts. in the means or apparatus employed for raising, removing, transporting, and re-fixing military or other targets or mantlets.
1223. William Clark, of Chancery-lane, impts. in repeating fire-arms,—a communication.
1224. Alexander Macmillan, of King's-road, Ball's-pond, impts. in buttons and in fastening buttons to garments.
1225. Robert Trefusis Mallet, of Bridge-street, Westminster, impts. in the construction of piers, walls, and other similar structures, and of landing stages; and in the connections therewith, or attachments thereto.
1226. John Patterson, of Beverley, impts. in machinery or apparatus for grinding, crushing, cleaning, and hulling or shelling various kinds of farm or vegetable produce; also applicable to the crushing or grinding of minerals and other substances.
1227. Joseph Papin, Charles Lintz, and Léon Lavacherie, of Paris, impts. in the manufacture of boots and shoes.
- The above bear date May 15th.*
1228. Richard Waddington, William Waddington, and Thomas Waddington, of Bradford, Yorkshire, impts. in combs for combing wool by machinery.
1229. Benjamin Browne, of King William-street, impts. in the manufacture of elastic material,—a communication.
1230. James Hinks, of Birmingham, impts. in lamps.
1231. Robert Talbot, of Chiswick, a folding rudder for steering barges in the River Thames or coastwise.
1232. Frederick Mann Burns, of Chorlton-upon-Medlock, impts. in preventing the fouling of the bottoms and sides of ships and vessels; particularly applicable to ships and vessels constructed of or sheathed with iron.
1233. William Clark, of Chancery-lane, impts. in rotary engines,—a communication.
1234. John Titus Newton, of Ystalyfera, near Swansea, impts. in machinery for planishing and rolling sheet metal.
1235. Joseph Gibbs, of Abingdon-street, Westminster, impts. in preparing and spinning flax and other vegetable fibres and filaments, and in machinery employed therein.
1236. William White, of Earl Shilton, Leicestershire, impts. in machinery or apparatus for the manufacture of looped fabrics.
1237. Thomas Cox Stretton, of Old Basford, Nottingham, impts. in machinery or apparatus employed in the dressing of lace or other fabrics.
1238. Edward Brown Wilson, of Parliament-street, impts. in the manufacture of iron and other metals, and in the apparatus employed therein; parts of which are applicable for other purposes where high temperatures are employed.
1239. James Whitehead, of Calverley, near Leeds, impts. in motive-power machinery, especially adapted for raising and forcing water and other liquids or fluids; parts of said impts. being applicable to steam engines and other machines fitted with pistons.
- The above bear date May 16th.*
1240. Eleazar Christmas, of Watford, impts. in carriages for common roads.
1241. William Watson, of Clipstone-street, impts. in the manufacture of bread, and in apparatus used for the same.
1242. Henry Bennett, of Wombridge Iron Works, Salop, impd. apparatus or mechanism to be used for facilitating the puddling of iron.
1243. Alfred Heather and John Redfern, of Southsea, impts. in the construction of steam boilers for marine, locomotive, and stationary engines.
1244. Benjamin Hebblewhite, of Kingston-upon-Hull, impts. in machinery or mills for crushing or reducing oil cake, seeds, and other substances,—a communication.
1245. Rest Fenner and William Henry Hight, of Red Lion-court, impts. in envelope folding machines.
1246. Samuel Toy, of Birmingham, impts. in machinery for making screw rivets, nails, or pins.

1247. Joseph Beaumont, of Moate, Westmeath, impts. in condensing machines for working yarns of wool and other fibrous substances.

*The above bear date May 18th.*

1248. Charles Barnard, John Bishop, Charles Barnard, junior, and Godfrey Barnard, of Norwich, impts. in lawn mowing and rolling machines.

1249. Stephen Rhodes, of Farnworth, impts. in machinery for twisting and doubling cotton, hemp, flax, and other like fibrous materials.

1250. John Edwards, of Basinghall-street, impts. in the permanent way of railways.

1251. John Henry Johnson, of Lincoln's-inn-fields, impts. in breech-loading fire-arms,—a communication.

1252. Ferrar Fenton, of Mappleton, Derbyshire, impts. in the treatment of certain vegetable fibres for the preparation of textile materials therefrom.

1253. Richard Bunting, of Sheffield, impts. in frames, tips, and bolsters used in cutlery, and in securing handles or scales therein or thereto.

1254. Henry John Olding, of Belvidere-road, Lambeth, impts. in treating flax and other fibrous plants in order to prepare the fibres thereof for spinning, and in apparatus employed therein.

1255. John Kelly, of Brook Lodge, Roscommon, Ireland, impts. in the preparation or treatment of peat or turf, and the manufacture thereof into charcoal and other fuel, drain pipes, building and other tiles, and in apparatus used therein.

1256. Abraham Parker, of Billericay, Essex, imptd. apparatus for saving from destruction by fire persons and property in houses, buildings, and ships, and also for ventilating ships,—a communication.

1257. Lasslo Chandor, of New York, imptd. mechanical lamp.

1258. Thomas Partridge Salt, of Birmingham, impts. in the manufacture of trusses.

1259. Lasslo Chandor, of New York, impt. in lamps.

1260. William Smith, of Mauchline, Ayrshire, N.B., impts. in transferring

plain or colored prints or designs to wood or other surfaces.

*The above bear date May 19th.*

1261. Henry Wren and John Hopkinson, of Manchester, impts. in the construction of self-lubricating bearings for shafts and axles.

1262. Joseph Coignard, of Nantes, impts. in sewing machines.

1263. Walter John Colin Lang, of Kirkeudbright, impts. in the manufacture of certain articles to be used for preserving life at sea and other purposes.

1264. Paul Addington, of Phipps-bridge, Merton, Surrey, impts. in the manufacture of varnishes.

1265. Robert Raynsford Jackson and William Pemberton, of Blackburn, impts. in looms for weaving.

1266. Thomas Williams and Isaac Naylor, of Bradford, impts. in paper spools or tubes used in spinning and doubling machines.

1267. John Thurgood Markall, of Fieldgate-street, Whitechapel, impts. in machinery for working of wood.

*The above bear date May 20th.*

1268. John Cassell, of La Belle Sauvage-yard, impts. in the treatment of mineral oils and hydrocarbons,—a communication.

1269. George Rogers Harding, of Wandsworth, impts. in the means of transmitting power on railways worked by vacuum or the pressure of air, and in the apparatus to be employed for such purpose.

1270. William Walker, of Manchester, impts. in looms for weaving.

1271. James Steart, of Saint James's-road, Bermondsey, extracting the fibre from *Zostera marina* and other aquatic vegetable productions.

1272. William Nunn, of St. George-street, impts. in the construction of signal lanterns or lamps.

1273. Frederic Pelham Warren, of Cosham, Hants, impts. in attaching copper or other sheathing to iron vessels.

1274. Edward Thomas Hughes, of Chancery-lane, impts. in breech-loading fire-arms, and in cartridges connected with the same,—a communication.

1275. Nathaniel John Amies, of Manchester, impts. in the manufacture of elastic webbing.
1276. Abraham Thomalley, of Burghle-Marsh, Lincolnshire, impts. in brick kilns.
1277. William Henry Clapp, of North-place, Ball's Pond-road, impd. rail or holder for coats or other articles.
1278. Edward Sonstadt, of Loughborough, impts. in the manufacture and purification of the metal magnesium.
1279. John Fawcett, of Huddersfield, impts. in the preparation of food for cattle, horses, and other animals.
1280. Joseph Goodman, of Blackfriars-road, impts. in velocipedes, and in the construction of wheels for the same and other carriages.
1281. Richard Archibald Brooman, of Fleet-street, impts. in breech-loading ordnance and breech-loading and other small arms,—a communication.
- The above bear date May 21st.*
1283. Charles Maschwitz, the younger, of Birmingham, impts. in stoppers or bungs for closing or stopping bottles, jars, and other vessels, and the muzzles of rifles, and for other like purposes,—a communication.
1284. Theophilus Alexander Blakely, of Montpelier-square, impts. in ordnance.
1285. Joseph Jones Habershon, John Matthew Habershon, and Matthew Henry Habershon, of Rotherham, impts. in machinery for rolling, polishing, straightening, and tapering round rods or bars of iron, steel, and other metals.
1286. Theophilus Alexander Blakely, of Montpelier-square, method of rifling guns and of forming projectiles to correspond therewith.
1287. George Stevens, of Victoria-terrace, Camberwell, impts. in coke ovens, and in building and heating ovens or retorts for generating coal gas, connected therewith.
1288. William Edward Newton, of Chancery-lane, impts. in the manufacture of waterproof fabrics,—a communication.
1289. William Edward Newton, of Chancery-lane, impd. machinery for the manufacture of waterproof fabrics,—a communication.
1290. James Higgins and Thomas Schofield Whitworth, of Salford, impts. in machinery or apparatus for roving, spinning, and doubling cotton and other fibrous materials.
1291. Augustus William Hofmann, of Fitzroy-square, impts. in preparing coloring matters for dyeing and printing.
- The above bear date May 22nd.*
1292. John Sturgeon, of Leeds, impts. in steam hammers.
1294. John Alexander Pickering, of Heath-cottage, Oatlands-park, impts. in covers or capsules for bottles, jars, and similar vessels.
1295. William Cormack, of Manchester, impts. in the distillation of coal tar, tar oil, resin, resin oils, all hydrocarbons, petroleum, or other mineral or vegetable oils and spirits derived therefrom.
1296. Samuel Egan Rosser, of Northumberland-street, Strand, and Josiah George Jennings, of Palace-road, Lambeth, impts. in chimneys, fireplaces, stoves, and flues for warming and ventilating apartments.
1297. John Solomon Bickford and George Smith, of Tuckingmill, Cornwall, a manufacture for firing explosive compounds.
1298. William Hoey, of Great George-street, Bermondsey, the preparation of a fluid for renewing the surface of japanned and enamelled leathers and cloths.
1299. John Hopkins, of New Basford, Nottinghamshire, impts. in points and in crossings used on railways and on tramways.
1300. Ferdinand Potts and John Key, of Birmingham, impts. in the manufacture of certain descriptions of iron tubing, and in the means of producing and applying an ornamental case to the same; which said means are also applicable to the production of ornaments in metal for other purposes.
1301. Richard Archibald Brooman, of Fleet-street, impts. in indicating the position of trains upon railways, and in apparatus employed therein,—a communication.

1302. Richard Archibald Brooman, of Fleet-street, impts. in the manufacture of bells and of resisting and non-cutting tools,—a communication.
1303. Richard Archibald Brooman, of Fleet-street, impts. in safety garments,—a communication.
1304. Frederick Kingsbury, of Cecil-street, Westminster, impts. in the construction of orchestras.
1305. George Smith, of Fenchurch-street, impts. in lamps for burning hydro-carbon oils,—a communication.

*The above bear date May 23rd.*

1306. James Hesford, of Cunliffe-street, Bolton, impts. in machinery and apparatus for stretching and drying cotton and other fabrics or materials.
1307. William Muir, of Manchester, impts. in machinery for cutting sugar and for assorting the lumps when cut.
1308. George Howell, of the Old Kent-road, a new double-action self-feeding stamping and printing machine.
1309. Henri Adrien Bouneville, of Paris, impts. in the construction of carriages,—a communication.
1310. Paul Leprovost, of Paris, impts. in carriages and vehicles for railways and other roads.
1311. Edmund Hunt, of Glasgow, impts. in posts or pillars for fences and gates,—a communication.
1312. Gustav Kötgen, of Barmen, Prussia, impd. binding to be used for trimming woollen cloth garments.
1313. Hippolyte Benigne Girard, of Paris, impts. in the heating of every industrial and private apparatus by means of the oxygen and hydrogen gases combined, and obtained from the decomposition of water.
1314. Thomas Spurrier, of Moseley, Worcestershire, impts. in the manufacture of ornamental metal cylinders.
1315. John Hilliar, of Cheapside, impts. in the construction of the frames, sashes, shutters, blinds, and ventilators for windows or other openings; part of which impts. are also applicable to other constructive purposes.
1316. Charles Hare, of Norwich, impts. in reclining and easy chairs.
1317. Richard Hayward, of Wapping, VOL. XVIII.

impts. in apparatus for bottling liquids, or for drawing or letting off at the same time liquids from several different casks or vessels.

1318. Martyn John Roberts, of Pen-darren, Brecknockshire, impts. in means of and apparatus for preparing, spinning, twisting, and doubling, wool, cotton, and other fibrous substances, and in lubricating the spindles and other parts of machinery used in these and other operations.
1319. John Watson Burton, Samuel Gibson Rhodes, and Samuel Exley Seanor, of Leeds, and William Scruton, of Liverpool, impd. machine or apparatus for getting coal or other minerals.
1320. William Clark, of Chancery-lane, impts. in apparatus for ruling paper and other materials, either alone or in combination with typographical or lithographical printing,—a communication.

*The above bear date May 25th.*

1321. Abraham Haley, of Frome, impts in Jacquard looms.
1322. James Munro, of Tillanburn, and Robert Scott, of Cambusnethan, both in Lanarkshire, impts. in apparatus for boring, mining, and excavating or cutting, in motive-power engines, and in pressure gauges.
1323. Edward Kenworthy Dutton, of Stretford, Lancashire, impts. in apparatus called "gins" for cleansing seed cotton.
1324. Michael Henry, of Fleet-street, impts. in apparatus for raising, forcing, and moving fluids,—a communication.
1325. James Buckingham, of Launceston, Cornwall, impts. in ploughs.
1326. Frederick William Kitson and James Kitson the younger, of Leeds, impts. in the manufacture of the tyres for railway wheels, and in the means of securing the tyres to the wheels.
1327. William Edward Newton, of Chancery-lane, impts. in machines for separating the fibre from the flesh of plants,—a communication.

*The above bear date May 26th.*

1329. William Clark, of Chancery-  
B

- lane, impts. in offensive and defensive arms,—a communication.
1330. Arthur Bastow, of Bradford, impts. in looms for weaving.
1331. Hiram Craven Coulthard, of Blackburn, impts. in blast engines.
1332. Howard John Kennard, of Great George-street, Westminster, impts. in the construction of wrought-iron cylinders for piers or piles to bridges, viaducts, or for other foundations or structures where the sinking of cylinders is required.
1333. Charles Gammon, of Cloak-lane, impd. spring fastening.
1334. William Palliser, of Dublin, impts. in projectiles for ordnance.
- The above bear date May 27th.*
1335. Francis Robert Piltz, of Frederick-street, Hampstead-road, impts. in the mode of producing ornamental surfaces, applicable to the general purposes of decoration.
1336. William Irlam Ellis, of Vulcan Foundry, near Warrington, impts. in steam boilers.
1337. Charles Thomas Boutet, of Brussels, impd. instrument for measuring distances and altitudes.
1338. George Gore, of Birmingham, impts. in gas burners and in gas furnaces.
1339. Charles Eugene Laederich, of Paris, impts. in watches.
1340. Henry Cartwright, of the Dean Broseley, Salop, impts. in apparatus for steering vessels.
1342. Thomas Richardson, of New-castle-upon-Tyne, and Robert Irvine, of Musselburgh, Mid Lothian, N.B., impts. in treating the waste liquor obtained in the preparation of Esparto grass.
1343. Frederick Osbourn, of Peckham, impd. apparatus for pressing, smoothing, and finishing garments or parts of garments.
1344. Henry Thomas White, of Piccadilly, impts. in hats, caps, and other coverings for the head.
1345. Thomas Jarvis, of Earl's-court, impts. in obtaining vegetable extracts, and in apparatus employed therein.
1346. Richard Archibald Brooman, of Fleet-street, impts. in paddle wheels,—a communication.
1347. William Needham and James Kite, of Vauxhall, impts. in expressing liquid and moisture from substances, and in separating the liquid from the solid portions thereof; applicable also to the filtration of liquids.
- The above bear date May 28th.*
1348. Eli Ironmonger, of Derby, impd. loose clip and socket joint, applicable to bedsteads, sofas, chairs, and other articles of furniture and of fencing.
1349. Alfred Abadie, of Fecamp, France, impts. in railway breaks.
1350. William Loeder, of New Broad-street, impts. in rails for railways,—a communication.
1351. Jerome Jean Pôtel, of Saint Quentin, France, impd. method of accelerating the draft in furnaces and fire-places.
1352. George Henry Pierce, of Plymouth, impd. apparatus for heating buildings by means of hot water.
1353. Robert Barker, of Grafton-road, Upper Holloway, impts. in the manufacture of matches, usually termed vesuvians.
1354. William Green, of Margaret's-place, Old Ford-road, impts. in the means or method of producing black coloring matters or pigments.
1355. John Henry Johnson, of Lincoln's-inn-fields, impts. in the manufacture or preparation of lubricating material,—a communication.
1356. François Patureau, of Paris, impts. in the manufacture of cardboard or paper boxes or receptacles.
- The above bear date May 29th.*
1357. Edward Thomas Hughes, of Chancery-lane, impts. in apparatus for the transmission of motive power,—a communication.
1358. Edward Payson Mosman, of Springfield, Massachusetts, U.S.A., impts. in obtaining and applying motive power.
1359. John Heard, of Crediton, impts. in apparatus for distributing manure.
1360. Valentine Baker, of Dublin, impts. in ordnance.
1361. Stephen Bates and John Jardine, of Radford, impts. in carriages used in machines employed in the manufacture of lace or other fabrics.—

1362. William Clark, of Chancery-lane, impts. in the manufacture of manure,—a communication.

*The above bear date May 30th.*

1363. James Henson, of Parliament-street, impts. in the construction of railway carriages.
1364. James Chalmers, of Knight's-place, Vauxhall, impts. in armour for forts and floating batteries.
1365. William Clark, of Chancery-lane, impts. in apparatus for printing fabrics, papers, and other surfaces in colors,—a communication.
1366. Frederick Warwick Smith, of Upper Thames-street, impd. apparatus for conveying goods, either in bulk or otherwise, whether to or from the warehouse or vessel, having an inclined, vertical, or horizontal movement, to be worked either by pressure of air, or by vacuum and atmospheric pressure.
1367. Lewis Scudder Chichester, of Brooklyn, New York, impts. in means for drying grain.
1368. John Davey, of Crafthole, Cornwall, impts. in horse rakes.
1369. Alfred Vincent Newton, of Chancery-lane, impd. construction of marine spike,—a communication.
1370. Charles Belcher, of Little Coxwell, Berkshire, impts. in cutting and transplanting turf, and in apparatus to be employed therein; which apparatus is also applicable to the extraction of weeds and to the planting of seeds, roots, sets, or plants.
1371. Hiram Craven Coulthard, of Blackburn, impts. in packing for the glands of piston rods and other moving mechanism, where it is necessary to prevent the passage of steam or other fluids.

*The above bear date June 1st.*

1372. James Mellard, of Rugeley, impts. in double-moulding or ridging ploughs.
1373. Abraham Illingworth, of Halifax, Yorkshire, impts. in boots and shoes, or similar coverings for the feet, and in the manufacture thereof.
1374. John Henry Brierley, of Halifax, the application of leather in the manufacture of gentlemen's scarfs and ties.

1376. David Wilson, of Wandsworth-common, and Edward Alfred Cowper, of Great George-street, Westminster, impts. in presses.

1377. George Allam Barrett, William Exall, Charles James Andrewes, and Alfred Barrett, of Reading, impts. in valves and apparatus for regulating the speed of steam engines,—partly a communication.

1378. Thomas Page, of Adelphi-terrace, impts. in shoeing horses.

1379. Etienne Joseph Jarry, of Paris, impts. in machinery to be worked by steam or other power, for clearing and ploughing land.

1380. Edme Henry Létang, of Paris, impd. ruling and printing machine, to be used either combined or separately.

1381. Robert Crawford, of Beith, Ayrshire, impts. in jacquard machines used for weaving ornamental fabrics.

1382. Thomas Agnew, jun., of Manchester, impts. in apparatus for coating or covering moulded or other surfaces with certain composition or material.

1383. William Gleave and Thomas Young, of Manchester, impts. in apparatus for feeding or supplying water to steam boilers.

*The above bear date June 2nd.*

1384. John Travis, of Royton, Lancashire, impd. method of preventing the incrustation of earthy matter in steam boilers, steam generators, and fuel economisers.

1386. Thomas Claridge, of Bilston, impts. in the manufacture of spur wheels used in the construction of mill and forge gearing, and for other like purposes.

1387. George Davies, of Serle-street, impts. in machines for ginning cotton,—a communication.

1388. Wellington Lee and John Gano Winter, of New York, impts. in steam fire engines,—a communication.

1389. Frederick Settle Barff, of Dublin, impd. means of protecting, preserving, and hardening surfaces of brick, cement, stone, stucco, and other analogous substances; which invention is also applicable to the preservation of timber.

1390. James Jennings McComb, of Liverpool, impts. in the construction of presses for forming bales of cotton and other materials; and in the construction of fastenings for, and means for applying, bands to such bales,—partly a communication.

1391. John Portlock, of Hampstead-road, impd. alarum apparatus.

1392. Joseph Maurice, of Langham-place, impts. in rulers or instruments for ruling, and in the mode of constructing them.

*The above bear date June 3rd.*

1393. Stephen Blake, Thomas Lee, and Robert Dutton, of Chester, impts. in the construction of flour and meal mills.

1394. Hugh Rigby, of Salford, impts. in steam-boilers and furnaces for the consumption of smoke.

1395. Mme. Veuve Leon de Wailly, of Paris, impd. method of preserving carpets from the effect of dust.

1396. Heinrich Pollack, of Hamburg, impts. in the manufacture of scarlet, brown, and orange colors.

1397. William Edward Newton, of Chancery-lane, impts. in the construction of casks, barrels, kegs, and other analogous articles,—a communication.

*The above bear date June 4th.*

1398. Samuel St. Barbe Guillaume, of Southampton, impts. in bricks, and in apparatus to be used in manufacturing the same, and in brick-work built therewith.

1399. Francis Alton Calvert, of Manchester, impts. in steam engines, steam boilers, and steam heating apparatus.

1400. Robert William Sievier, of Guildford-street, impts. in jacquard machines,—a communication.

1402. Richard Archibald Brooman, of Fleet-street, impts. in treating liquorice root to obtain liquid and solid extracts therefrom,—a communication.

1403. Thomas Gray, of Lower Mitcham, impts. in treating flax, hemp, and other vegetable fibrous substances, in order to bleach and separate the fibres.

1404. Joseph Seaman, of Worcester,

impts. in implements to be used in the cultivation of the soil.

1405. William Clark, of Chancery-lane, impts. in the distillation and separation of hydro-carburets and their derivatives, and in apparatus for the same,—a communication.

1406. John Henry Johnson, of Lincoln's-inn-fields, impts. in smoothing irons,—a communication.

*The above bear date June 5th.*

1407. William Armitage Brown, of Canterbury, an indicator for railway trains.

1408. Richard Wallis, of Basingstoke, impts. in apparatus for loading and unloading vessels, and for elevating and otherwise conveying sacks, casks, and other packages, parcels, or objects from one locality to another.

1409. Alfred James Hollingsworth, of Southampton, impd. spirit compass, with screw lever.

1410. Charles Edward Newcomen, of Ovington-square, Brompton, impts. in the treatment of peat and other substances containing moisture.

1411. James Hogg, jun., of Fleet-street, impts. in the manufacture of show cards.

1412. Nicholas Walton, of Aldenham-street, St. Pancras, impts. in apparatus for drying and airing clothes.

1413. William Coare Brocklehurst, of Macclesfield, and Joseph Creighton, Charles Makinson, and John Creighton, of Manchester, impts. in machinery or apparatus for winding yarns or threads.

1414. William Miller, of Upper Stamford-street, impd. mode of constructing ships, vessels, or boats, and of apportioning their freight to that construction, so as to prevent their sinking or being destroyed by fire.

1415. William Clark, of Chancery-lane, impts. in mounting and fitting bedsteads, chairs, and other moveable seats on board ship,—a communication.

1416. William Clark, of Chancery-lane, a new and useful device for turning cross-head wrists or pins, or for turning any cylindrical part of machinery which is secured between two arms,—a communication.

1417. Edwin Arthur Schofield, of

- Eyam, Derbyshire, impts. in tools or apparatus for paring, rasping, and scraping the edges of boot and shoe soles and heels.
1419. William Edward Gedge, of Wellington-street, impts. in the construction of kites,—a communication.
1420. James Grafton Jones, of Cumming-street, Pentonville, and Robert Ridley, of Leeds, impts. in machinery and apparatus for working coal and other mines.
1421. Edward Humphrys, of Deptford Pier, impts. in surface condensers.
1422. Robert Charles Furley, of Edinburgh, impts. in the preparation of castor and other oils for medicinal use.
1423. Henry Reynell, of Exeter, impts. in the manufacture, by the introduction of cocoa-nut husk, or part thereof, of a substitute for ordinary felt and kamptulicon, and in utilizing said cocoa-nut husk, or part thereof, for packing of wine coolers, refrigerators, and ice chests, and caulking of ships and vessels.
1424. William Edward Newton, of Chancery-lane, impt. in needles,—a communication.
1425. William Edward Newton, of Chancery-lane, impts. in nozzles for hose and water discharge pipes,—a communication.
1426. John Petrie, of Rochdale, impts. in machinery or apparatus for washing wool and other fibrous materials.
1427. Thomas Page, of Adelphi-terrace, impts. in propelling vessels, and in apparatus for the same.
- The above bear date June 8th.*
1428. George Hills, of Blackheath, impts. in obtaining certain products from hops.
1429. Benjamin Dobson and Daniel Greenhalgh, of Bolton, impts. in machinery or apparatus for preparing cotton and other fibrous substances.
1430. Edward Barlow, of Bolton, James Newhouse, of Farnworth, and Francis Hamilton and William Hope, of Bolton, impts. in machinery for grinding card teeth.
1431. Charles Niquet, of Paris, impts. in apparatus for sorting and washing ores.
1432. John Edwards, of Basinghall-street, impts. in railway chairs and sleepers.
1433. Richard Archibald Brooman, of Fleet-street, impts. in the distillation of bituminous substances,—a communication.
1434. John Murray, of Whitehall-place, impts. in clips or holders for inserting and fixing photographic pictures in albums.
1435. Henry Martin, of Surrey-square, impts. in treating and preparing night soil and sewage with other materials as a manure.
1436. Michel Siegrist, of Ewell, impts. in the construction of fountains.
1437. William Edward Newton, of Chancery-lane, impts. in the propulsion of ships and other vessels,—a communication.
1438. Henry Frederick Mc Killop, of Belvedere, Kent, impts. in compositions for coating or covering ships' bottoms.
1439. Henry Bessemer, of Queen-street-place, impts. in the construction of, and mode of working, hydrostatic presses and hydraulic apparatus.
- The above bear date June 9th.*
1440. William Madders, of Manchester, impd. ornamental fabric.
1441. Russel Aitken, of Cambridge-street, Pimlico, impts. in the permanent way of railways.
1442. William Roberts, of Millwall, impts. in steam boilers.
1443. Thomas Adams, of Alfred-terrace, Bermondsey, impts. in slide and other valves, and apparatus connected therewith.
1444. Joseph Brooke, of Laister Dyke, Yorkshire, impts. in miners' lamps.
1445. William Wells and John William Myers, of Manchester, impts. in apparatus for obtaining artificial light from volatile liquids or fluids.
1446. Thomas Evans, of Manchester, and Edward Hughes, of London, impts. in apparatus for applying one or more colors of ink to type in letter-press printing by hand.
1447. William Clark, of Chancery-lane, impts. in locomotive apparatus, which is also applicable to other purposes,—a communication.
- The above bear date June 10th.*



1448. Moritz Hatschek, of Pesth, impd. method of mashing.
1450. Thomas Maddocks Harrison, of Birmingham, impts. in the manufacture of metallic casks.
1451. Michael Henry, of Fleet-street, impts. in treating floss silk and silk waste, and in apparatus for the same and other like purposes,—a communication.
1452. John Francis Kain, of Fleur-de-lis-street, Norton Folgate, impts. in umbrellas, parasols, sun-shades, walking-sticks, and whips, and in brooches and other ornaments.
1453. Edward Deane, of Arthur-street East, London-bridge, impts. in cooking and culinary utensils.
1454. Charles Louis Van Tenac, of Tredegar, impd. in railway wooden sleepers,—a communication.
1456. James Webster, of Birmingham, impts. in indurating iron, and in protecting iron and steel from oxidation.
1457. William Walton, of Smethwick, impd. pneumatic hammer, useful also for punching and stamping metals.
1458. Jules Albert Schlumberger, of Basle, Switzerland, impts. in the preparation of aniline dyes or coloring matters for dyeing, staining, or printing textile substances.
1459. William Seed, of Preston, impts. in machinery for drawing, slubbing, roving, and spinning cotton and other fibrous material.
1460. Edwin Owen Hallett, of Weymouth, impts. in constructing the sides of ships, batteries, and fortifications, and in applying armour plates thereto.
1461. James Johnson, of Peterborough, impts. in lubricating apparatus for the cylinders of steam engines.
1462. James Johnson and William Braithwaite, of Peterborough, impts. in reversing levers for locomotive engines and others.
1463. Thomas Alexander Elliott, of Enniskillen, impts. in reefing topsails and courses.
1464. William Simms, of Reading, a new compound extract to be employed as a means for the cure of deafness.
1465. Francis Alton Calvert and Francis Calvert, of Manchester, impts. in machinery for burring, ginning, cleaning, and carding cotton, and other fibrous substances.
1466. George Davies, of Serle-street, Lincoln's-inn, impts. in the currying and finishing of leather,—a communication.
1467. Joseph Place, of Hoddlesden, impd. combination of materials to be employed for the purposes of sizing and stiffening.
1468. John Charles Wilson, of Cannon-street, impts. in machinery for reducing cocoa-nut kernels and other substances to a state of pulp.
1469. John Charles Wilson, of Cannon-street, impd. machine for unhusking rice and other seeds.
1470. George Bedson, of Manchester, impts. in cupolas and blast furnaces.
1471. Thomas Charles March, of St. James's Palace, impts. applicable to the ornamentation or decoration of articles of furniture; part of which impts. may also be applied for architectural ornamentation.
1472. Thomas Hughes Milner, of Edinburgh, impts. in thrashing machines,—a communication.
1473. Robert Hughes, of Worcester, an impd. implement or apparatus for scraping and sweeping turnpike and other highways, carriage drives, and footwalks, or other places requiring to be so cleaned.
1474. Henry Stracey Barron, of Blackheath-road, impts. in steam fire engines; parts of which impts. are applicable to steam boilers and to pumps generally.
1475. John Furness Tone, of Newcastle-upon-Tyne, impts. in the prevention of smoke in steam boilers and other furnaces,—a communication.
1476. George Davidson, of Mugie Moss, Aberdeen, impts. in the manufacture of paper bags and in the machinery employed therein.
1477. John Jones, of Manchester, impts. in gas regulators.

*The above bear date June 11th.*

1464. William Simms, of Reading, a new compound extract to be em-

*The above bear date June 12th.*

1478. George Davies, of Serle-street,

- impd. mode of oiling journals or axles,—a communication.
1479. Thomas Wrigley, of Bury, impts. in machinery or apparatus for filtering or cleansing water or other fluids.
1480. John Hopkinson, of Manchester, impts. in the mode of securing or fastening the ends of metal bands, and in machinery for preparing the same.
1481. William Nelson Hutchinson, of Plymouth, impts. in means of, and apparatus for, cleansing ships' bottoms and sides.
1482. Robert Blackburn, of Exeter, impts. in traction engines.
1483. Thomas Alexander Elliott, of Enniskillin, impts. in the construction of, and in the means of ballasting, ships and other vessels.
1484. Aimé Méhu, of Petit Talard, near St. Malo, France, impd. helm for working the rudders of ships or vessels.
1485. John Solmons Benson and David Jones, of Birmingham, impd. construction of removable head for casks, applicable to the closing of other vessels.

*The above bear date June 13th.*

## New Patents Sealed.

1862.

3379. G. A. Huddart.  
3388. J. and A. Brierley.  
3390. John Savory.  
3391. Joseph Longland.  
3398. E. B. Wilson.  
3399. David Davidson.  
3402. J. B. Morrison.  
3409. J. Platt and W. Richardson.  
3411. F. C. Bakewell.  
3414. A. S. Stocker.  
3416. E. R. Dann.  
3417. R. A. Brooman.  
3427. George Haseltine.  
3430. T. C. Hinde.  
3435. A. P. Tronchon.  
3438. William Henderson.  
3439. William Clark.  
3444. James Taylor.  
3445. J. and W. Lord.  
3454. E. T. Loseby.  
3459. James Petrie.  
3460. Matthew Ker.  
3461. J. G. Taylor.  
3463. J. H. Riddell.  
3465. Frederick Tolhausen.  
3470. John Johnston.  
3474. F. B. Anderson.  
3475. W. and H. Bowser.  
3476. William Mould.  
3481. Reuben Bottomley.  
3482. W. B. Adams.  
3485. J. W. P. Field.  
3489. Francis Loret.

1863.

1. R. H. Collier.  
4. M. E. Bowra and A. E. Francis.  
7. J. J. Southgate.  
9. William Soutter.

10. William Robinson.  
11. J. E. Baker and J. Landon.  
12. W. A. Distin.  
13. F. C. Bakewell.  
16. A. Bamford, R. Blomley, R. Taylor, and J. Lett.  
18. W. H. Muntz.  
19. H. J. Sergeant.  
20. J. E. Dowson.  
21. R. C. Ransome.  
22. A. S. Bolton.  
25. William Philippi.  
26. Stephen White.  
27. William Astrop.  
28. C. B. Clough.  
31. E. B. Keeling.  
34. J. Howard and J. Bullough.  
38. Humphrey Chamberlain.  
39. D. Nevin and W. Coppin.  
42. C. T. Judkins.  
43. James Eckersley.  
44. John Leigh.  
47. Matthew Hodgart.  
48. E. V. Gardner.  
49. J. G. Dahlke.  
50. George Turner.  
51. J. Whitworth and W. W. Hulse.  
59. G. C. Grimes.  
60. G. A. Huddart.  
61. Thomas Aveling.  
62. George Dowler.  
65. J. H. Johnson.  
69. Cecil Allen.  
70. R. T. Monteith and R. Monteith.  
72. Charles Worssam.  
73. W. H. Tucker.  
75. C. E. Gray.  
79. E. T. Hughes.  
83. William Tasker, jun.  
87. Robert Lüthy.

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|-----------------------------------|----------------------------------------------------------|
| 88. Maurice Vogl.                 | 230. A. L. Liétout and J. B. Roisin.                     |
| 90. Ferrar Fenton.                | 232. H. H. Henson.                                       |
| 94. Ebenezer Stevens.             | 245. H. B. Barlow.                                       |
| 97. William Clark.                | 246. W. E. Gedge.                                        |
| 101. J. B. Fenby.                 | 250. Charles Mace.                                       |
| 103. D. and J. Tannahill.         | 252. F. W. Wymer.                                        |
| 105. L. T. Stroud.                | 259. E. G. Muntz.                                        |
| 106. C. H. Townsend and J. Young. | 260. Henry Crichley.                                     |
| 107. R. A. Brooman.               | 271. C. H. G. Williams.                                  |
| 111. Lucien Lescuyer.             | 272. Arthur Pritchard.                                   |
| 117. J. A. Schlumberger.          | 274. William Clark.                                      |
| 118. J. S. Butler.                | 276. F. G. Stuber.                                       |
| 120. G. A. Biddell.               | 288. Frederick Tolhausen.                                |
| 122. John Lawson.                 | 292. F. G. Grice.                                        |
| 123. Edmund Morewood.             | 314. G. T. Bousfield.                                    |
| 125. Thomas Wilkinson.            | 320. C. and D. Faulkner, J. Fairley,<br>and W. C. Stiff. |
| 126. William Johnson.             | 321. J. A. Manning.                                      |
| 129. Edward Howes.                | 325. William Betts.                                      |
| 130. T. C. Barraclough.           | 331. B. F. Bates.                                        |
| 131. T. C. Barraclough.           | 347. C. Parigot and A. Grivel.                           |
| 132. John Harrop.                 | 391. John Grantham.                                      |
| 133. G. Graham and J. McLeod.     | 408. William Clark.                                      |
| 134. Robert Ferrier.              | 437. Desiré Tassin.                                      |
| 135. L. P. Josse.                 | 457. William Trustrum.                                   |
| 137. J. P. Bath.                  | 467. William Clark.                                      |
| 139. J. W. Child.                 | 468. William Clark.                                      |
| 140. Alexander Prince.            | 485. W. H. Gauntlett.                                    |
| 141. W. E. Newton.                | 514. William Clark.                                      |
| 142. D. F. Leblanc.               | 535. Henry Edmonds.                                      |
| 143. R. A. Brooman.               | 558. William Gray.                                       |
| 145. Lewis Verdure.               | 567. Joseph Maxfield.                                    |
| 150. John Edwards.                | 598. D. B. Parsons.                                      |
| 152. Isaac Ashe.                  | 614. W. E. Newton.                                       |
| 153. John Combe.                  | 682. C. T. Lutwyche and H. Lutwyche.                     |
| 156. W. E. Newton.                | 741. G. H. Smith.                                        |
| 157. Ephraim Sabel.               | 791. N. R. Hall.                                         |
| 164. J. J. Lundy.                 | 875. James Macintyre.                                    |
| 167. Joseph Mosheimer.            | 899. R. K. Penson.                                       |
| 171. H. A. Bonneville.            | 906. Ste. Aure Couperie.                                 |
| 173. William Clark.               | 913. H. W. Ripley.                                       |
| 177. J. W. Mearns.                | 914. Henry Caudwell.                                     |
| 178. Andrew Phillips.             | 930. Robert Newton.                                      |
| 183. James Holt.                  | 983. W. E. Newton.                                       |
| 185. William Clark.               | 994. W. E. Newton.                                       |
| 187. Ernest Bazin.                | 1007. J. W. Proffitt and W. L. Duncan.                   |
| 189. Sir Coutts Lindsay.          | 1025. W. A. Shaw.                                        |
| 192. H. Caro and J. Dale.         | 1043. A. V. Newton.                                      |
| 193. Henry Holcroft.              | 1047. H. E. Carchon and E. F. Raybaud.                   |
| 198. J. M. Binger.                | 1060. J. and W. Marris.                                  |
| 201. William Clark.               | 1065. G. W. Fuller.                                      |
| 202. Nicholas Wood.               | 1075. John Rowley.                                       |
| 203. Thomas Lambert.              | 1090. Edward Mitchell.                                   |
| 206. John Milner.                 | 1099. Joseph Badart.                                     |
| 210. F. N. Gisborne.              | 1125. W. C. Wilkins.                                     |
| 213. Cornelius Turner.            | 1137. A. V. Newton.                                      |
| 216. W. Mellor and W. Whaley.     | 1140. Peter Bourne.                                      |
| 222. A. J. Sax.                   | 1159. G. T. Bousfield.                                   |
| 226. W. F. Stanley.               | 1218. G. T. Bousfield.                                   |
| 227. J. B. Fell.                  |                                                          |

•• For the full titles of these Patents, the reader is referred to the corresponding numbers in the List of Grants of Provisional Specifications.

# NEWTON'S

## London Journal of Arts and Sciences.

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No. CV. (NEW SERIES), SEPTEMBER 1st, 1863.

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### ALUMINIUM BRONZE.

THE important part which the new metal, Aluminium, appears destined to play in the arts, chiefly as an alloy, induces us to direct the attention of our readers to the peculiarities of aluminium bronze which, if considered both in respect of its characteristics and its market value, will be esteemed by manufacturers as virtually a new metal.

When the French chemist, M. Deville, published, in 1854, an account of his experiments upon the preparation and properties of aluminium, great hopes were entertained that it might be produced at a sufficiently low price to admit of its receiving many practical applications, to which it seemed suitable on account of its remarkable qualities. A metal, being but little more than one-third of the specific weight of copper, and considerably less than half that of the lightest of the commercial metals, zinc; unacted on by oxygen or sulphur, and but little affected by most acids; possessing at the same time tenacity, combined with ductility, and having a moderately high melting point,—might well be supposed, *a priori*, to be susceptible of many interesting and very important uses. Up to the present time, however, these expectations concerning aluminium have not been realized. Although it is now produced on a considerable scale, the price remains too high\* to permit of its being put to many uses to which it might be applied if it were a cheap metal; and its peculiarly dull color is an impediment to its employment where beauty and brilliancy of appearance are desirable. Independently, however, of its usefulness *per se*, there seems to be a wide field open for the application of aluminium in the form of alloys with the more ordinary metals, the properties of which are changed in a remarkable manner by its presence, even in small quantities. On the other hand, very small quantities of the common metals destroy the ductility and malleability of aluminium itself—in some cases altering its color, and, in others, rendering it as brittle as glass: mixed, however, with a certain proportion of copper, an alloy is produced which possesses the properties of a valuable metal, capable of application

\* The present price in London is about 5s. per ounce.

not only very important in themselves, but for which it seems difficult to find any other metal or metallic alloy equally suitable. This mixture of aluminium and copper is the alloy called aluminium bronze. The alloy seems to have been first made a few years ago by Dr. Percy. Many of our readers will remember the specimens which were placed in the International Exhibition by Messrs. Bell, of Newcastle; and a later exhibition of articles manufactured from this substance by Messrs. Mappin, of Regent-street, must have familiarised most persons with its fine general appearance. Beauty of external appearance, however, is but one quality of a metal, and although an all important one, in certain respects, it is one without which, as in the instance of iron, the metal may possess the most valuable and interesting properties. Without beauty of surface, it is true that its applications must be limited to the useful; but in England, where the employment of metallic substances is so varied and so extensive, mere beauty is a secondary consideration. In the case of aluminium bronze, however, beauty of exterior and more sterling qualities are united. In color, this alloy resembles gold so closely, that it would be difficult by mere inspection to distinguish one from the other; but its mechanical qualities excel those of gold. It is composed of copper and about 10 per cent. of aluminium melted together, and re-melted once or twice. It is stated that the most essential condition to success in producing the alloy is purity in the copper employed; the best copper for the purpose, although its price prevents it from being much used, being that deposited by galvanic action: the next best is that from Lake Superior, which is very pure, and yields, with aluminium, a very good alloy. The re-melting of the alloy is a matter of great importance. The first melting appears to produce intimate mechanical mixture, rather than chemical combination of the metals; as in the proportion of 10 of aluminium and 90 of copper, an alloy of a very brittle character is produced by the first melting; but renewed opportunity of uniting into a definite chemical compound being afforded by repeated melting, a more uniform combination seems to take place, and a metal is produced free from brittleness, and having about the same degree of hardness as iron. The alloy containing rather less than 10 per cent. of aluminium, is said to possess the most uniform composition and the best degree of hardness; but it is not always an easy thing to produce this desirable uniformity of texture; as patches of extreme hardness sometimes occur, which resist the tools and are altogether unamenable to the action of the rollers. The alloy produced by this combination of copper and aluminium is very tenacious, malleable, rigid, light in weight, and possesses a fine golden color. Its qualities being so various, we have to view it in two different characters, viz.,—as suitable to

the manufacture of ornamental articles, to which it is adapted from the closeness of its resemblance to gold; and as capable of being applied, on account of its valuable mechanical properties, to useful purposes, to many of which it seems to be better fitted than any other metal or alloy.

With regard to the first, but what is really, after all, the least important of its characters—that is, its adaptability to ornamental uses—the points to be considered are: color, condition of surface, capability of receiving impressions from dies, or being worked and chased, and, lastly, insusceptibility to the action of oxygen and sulphur. What is the situation of aluminium bronze with reference to these questions? In its application to ornamental purposes, this alloy is, undoubtedly, a valuable addition to the resources of the artist, inasmuch as it affords him the means of imitating almost exactly the effect of gold, in a material very superior to the ordinary gold substitutes, homogeneous in texture and color, and comporting itself, with respect to external influences, more like silver than like a cheap alloy. In sculptured and chased work, it presents a similar depth and richness of effect with gold, and in polished surfaces it is almost equally brilliant; whilst, in cases where it is thought that the color of the alloy does not afford a sufficiently close approach to the tint of pure yellow gold, it will probably, as a gilding metal, present the best possible foundation for a coating of fine gold.

In many respects, therefore, the new alloy may be reasonably expected to play an important part in relation to ornamental work. It remains to examine its qualities with regard to important mechanical applications, and it is here that the valuable qualities of the alloy come out in the strongest manner. In respect to this part of the subject, the properties of the metal to be considered are its tenacity, malleability, power of resisting compression, rigidity, founding qualities, behaviour under the action of tools, and specific weight. With regard to most of these points, the aluminium alloy compares with great advantage with all other metals and alloys. In experiments made in the Royal Gun Factory at Woolwich, by Mr. Anderson, upon the tensile strength of this metal, he found it to exceed that of the best gun metal in the ratio of 2 to 1; the aluminium bronze sustaining a strain of 73,185 lbs. to the square inch, the gun metal not more than 35,040 lbs.; whilst the tensile strength of the best cast steel is about 72,000 lbs. So with regard to the power of resisting compression, it was found that a specimen of the alloy bore a crushing force of 132,000 lbs. per square inch, whilst there were no indications of compression until 20,384 lbs. per square inch had been applied; the strength of the alloy under compression ex-

ceeding that of the best cast iron, which may be taken at less than 120,000 lbs. The superiority of the metal extends likewise to the question of transverse strength or rigidity, wherein it surpasses gun metal in the ratio of 3 to 1, and brass in the ratio of 44 to 1. As a founding metal it can be employed without difficulty, and it produces castings, of any size, of the best character; whilst under the file, and in the lathe, it can be worked almost as easily and freely as gun metal. Although it can be rolled into sheets, it is said that it does not solder very readily nor strongly, and this might perhaps prove some impediment to its use in producing certain forms of work. But in every other respect ordinary mechanical manipulation can be applied to it with the greatest success.

There is an important quality of the alloy not yet mentioned, that is, its low specific gravity. The weight of the bronze, containing 10 per cent. of aluminum, is 7.68, a weight which corresponds very nearly with that of wrought iron; so that, taking into consideration the superior strength of the material, and the consequent smallness of parts necessary in an apparatus constructed from it, we perceive that, from the lowness of its specific gravity, the work would be extraordinarily light. Altogether, in a mechanical sense, this alloy seems to compare most closely with steel; and it is the opinion of competent persons, that in certain kinds of apparatus and instruments, the oxidizable steel may be well substituted by the comparatively unoxidizable aluminium alloy. It is probably in the construction of high-class philosophical apparatus, therefore, that the great value of this alloy will be found. In such work, combined strength and lightness are requisite, and these qualities are united in the highest degree in aluminium bronze. It can be engraved with great sharpness and regularity, and the engraved lines are said to be remarkably distinct. Writing on this subject, Lieut.-Col. Strange observes, that experiments, and the concurrent testimony of those who have given it a fair trial, prove that 10 per cent. aluminium bronze is superior, not in one or some, but, in every respect, to any metal hitherto used for the construction of philosophical apparatus.

The present price, about 6s. 6d. per lb., of the alloy, is no doubt an obstacle to its extended use. In cases where elaborate workmanship is required, the price will, however, bear but a small proportion to the value of the work; and the important question, under such circumstances, is not the difference of a few shillings in the value of the raw material, but the existence of qualities in that material which will ensure the greatest possible effectiveness in the manufactured article.

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## MODERN INQUISITORS.

It has been the frequent boast of English patriots that the "Holy Inquisition," even in the palmiest days of Popery, could find no resting place in this island. If, however, the followers of Ignatius were unable to render their doings palatable to the country, inquisitors of another class have, through the magical words "reform" and "retrenchment," taken so firm a hold, that a kind of *carte blanche* has been given them, to choose at pleasure victims for persecution. Formerly, when torture was applied by the Inquisition, it was limited to those few and exceptional individuals who were afflicted with an excessive amount of conscientiousness; but, alas! for these evil days, it is now a much larger class—even the unconscientious—who are marked for the operations of our modern inquisitors. Furthermore, the sufferings of the victims in the olden time, although they were sufficiently intense, were borne in secret; but now the case is aggravated, for the world is called to witness and deride at, if it so please, the victims' agony. The modern inquisitors to whom we refer, are none other than our legislators, whose powers of probing into private affairs seem to be quite equal to that of their dreaded predecessors, while the practice of conducting their investigations adds intensity to the cruelty, from the fact that the printing press is invariably employed to blazon the details to the world. Sometimes they hunt in bands, and sometimes singly, and very rarely (no matter what the character of the hunt) do they miss their game. This is no very new institution, but yet it claims our attention at this time, by reason of a "return relating to patent law expenses," ordered by the House of Commons to be printed, in July last. In this case Mr. Dillwyn acted the part of inquisitor. He has certainly sprung a pretty quarry, but whether intentionally or not is not for us to determine; at any rate, it has, for the moment, succeeded in eluding his grasp.

The member for Swansea had evidently been studying the details of those interesting annuals which the Commissioners of Patents for Inventions are bound to furnish to the public; and among other matters, his attention had been arrested by the first item in the account of the salaries paid to the clerks and officers appointed under the Act. Let us assume (for it is not a very unreasonable assumption) that he was struck with the apparently inadequate sum apportioned to the Clerk of the Commissioners. Even without knowing his precise duties, it would be evident, to any casual reader of the Commissioners' report, that the "Clerk of the Commissioners" was no other than their Secretary, the directing head



and representative of the executive of the Patent Office. How then could £600 per annum be an adequate remuneration for such a service of trust as the office implies; more especially when the Chief Clerk in the patent division, whose duties must necessarily be of a routine character, receives £500 per annum, and the Superintendent of Specifications, an officer with no responsibilities besides those of his department, £1000 per annum? This apparent inequality might well court investigation, and investigation it has had. Mr. Dillwyn called for a return of "the duties performed by the Clerk of the Commissioners;" and he also gave this under-paid official an opportunity of indirectly setting forth his wrongs, by requiring further "the number of meetings of Commissioners, and days of attendance of the Clerk at the office of the Commissioners, during the year ending the 31st day of March, 1863." Whether Mr. Dillwyn's proceeding was dictated by the generous feeling which we have attributed to him, or by one of a more cynical character, is all one to the unfortunate secretary, for to him he has proved none other than a dreaded inquisitor. This is not the first time that we have seen a patent office clerk virtually pilloried, by being compelled to answer a few simple questions. In the year 1848, a committee was appointed to inquire into the circumstances connected with the offices of the clerks of the Signet and the Lord Privy Seal; their first witness—the clerk of the Patent Bill Office—having stated the emoluments of his office to average about £2100 per annum, was considerably disconcerted by the request, "Will you describe the duties which *you* perform in the Patent Office." The inquisitors having obtained an account of the duties of the office, proceeded, "You have assistants, have you not?"—Answer, "Yes, clerks." "Would not they be competent to continue the traditionary knowledge of the office?"—"Yes, they would, except in special cases where new grants are required." "You said that those special cases were not frequent, and that if any doubt arose in your mind, you refer for instructions to the Attorney or Solicitor-General."—"Yes." Thus was extracted a virtual confession that the post of the poor patent clerk was a sinecure.

The Clerk of the Commissioners, however (also styled Clerk of the Patents), unlike the patent clerk, is ready with a clear and direct answer to the inquiry as to his duties. They are as anyone might have imagined. He says, "The whole duties, responsibilities, and superintendence of the Patent Office, Public Library, and Museum *is* consequently in the Clerk of the Patents." When, or how, he performs these duties he has not given a very distinct account; for the days of attendance at the Office of the Commissioners, although required by the return, his modesty has not allowed him to notice. We have, however, this clear reply, viz.,—that

"the formal meetings of the Commissioners of Patents, under the Act, were four, during the year ending the 31st March, 1863." From this we may fairly infer that this responsible officer attended at least *four* times during the year to his duties. What amount of business was transacted at these meetings we cannot, as they were private, discover; but one subject, which was discussed and disposed of, shows, at least, that the heart of the Clerk of the Commissioners is in the right place. Content with his own small salary, as we believe he is, and fully conscious of the excess of the salaries of the Superintendent of Specifications, and the Chief Clerk, respectively, considering their subordinate duties and responsibilities, he wished, in some way, to reduce the current expenses of the office, and therefore curtailed the supply of books and periodicals to the library. A petition, signed by several influential persons, deprecating this change, having been presented to the Commissioners, the order was, happily, rescinded: but this act of the Clerk of the Commissioners shows, at least, that he does, to the best of his judgment, exert the authority imposed on him,—and what more can be expected from any man?

In case Mr. Dillwyn's intention should be to secure an increase of the salary of the Clerk of the Commissioners—which increase we feel sure that functionary does not desire,—we may inform him that this is not the sole solace which a generous government has afforded to a long tried servant, who can boast of thirty years service in the Great Seal Patent Office; and, also, that to push the inquisition further might possibly bring about an untoward result. The inquiry respecting the duties of the Clerk of the Patent Bill Office, it is true, ended happily for him, inasmuch as he is now in receipt of a pension of £850 out of the patent fund; but it does not follow that the like result can be ensured in all cases. Besides his salary of £600, already noticed, the Clerk of the Commissioners has also, by virtue of his office as Clerk of the Patents, £400 per annum. He is also Reading Clerk and Clerk of Committees in the House of Lords, and for constant attendance during the Session, he receives the additional *douceur* of £1500. If, therefore, his attendances at the Patent Office are not so numerous as might be expected of him, during the sitting of Parliament, it must be acknowledged that the Clerk to the Commissioners is faithfully serving his country, although in another capacity; and it cannot, with truth, be alleged that any inconvenience is experienced by his absence from office. This being so, it is only natural that he should avail himself of the rising of Parliament to flee from town, and in the hot days of August apply his yet unexhausted energies to that pursuit which is no less exhilarating than useful. If there were no sportsmen, should we not be overrun with birds, to the great detriment of the crops? Well.

is it, therefore, that those who can be temporarily spared from the too absorbing duties of a sedentary life, should be so patriotically inclined as to inaugurate, gun in hand, the festive seasons set apart for gathering in the feathered harvests of grouse, partridges, and pheasants. The physical labour is no doubt great, but the gain to the nation is great also. Let us pass over, then, the short term between the close of grouse shooting and the opening of Parliament, yet unaccounted for in the round of occupations of a tried public servant,—assigning those few weeks for repose; for it must be admitted, that a salary of £2500 per annum would be but a poor remuneration, if its recipient had not some little time allowed him to spend it,

### Recent Patents.

To MATTHIAS EDWARD BOWRA, of *Upper Norwood*, and ARTHUR EDWARD FRANCIS, of *Tokenhouse-yard*, for improvements in the manufacture of elastic fabrics.—[Dated 1st January, 1863.]

THIS invention has for its object the production of an elastic fabric or material, consisting of a combination of fabrics with any suitable gums in an unvulcanized state.

The first improvement consists in causing any suitable elastic gums when formed into sheets of the required thickness and dimensions, to be distended in or upon suitably constructed frames or tables, in which the sheets are prevented from contracting crosswise, at the same time that they are distended lengthwise, and *vice versa*. While the sheets are in this condition, a fabric, made of cotton, wool, silk, or other material adapted for the purpose, is caused to adhere thereto,—such fabric being also first distended lengthwise, but allowed to contract crosswise. When the sheets of elastic gums and fabrics have been thus treated and caused to adhere firmly together, the combined materials are released from their tension and allowed to contract. By this means, a fabric is produced possessing elasticity in all directions.

The second improvement consists in the production of an elastic fabric in the following manner:—Suitable fabrics of wool, silk, cotton, alpaca, or other materials are distended lengthwise, and by this means caused to contract crosswise; and when so distended and contracted, they are covered with a coating of India-rubber or other elastic gum. The adhesion of the gum to the fabric so distended in a lengthwise direction, prevents the same from returning to its previous state of distension in a crosswise direction. The article, produced by the materials thus combined, will therefore possess elasticity in a crosswise direction.

This improved manufacture it is proposed to apply to or for the springs of boots and shoes, belts, braces, doors, windows, tobacco pouches, bags, and the like, and to or for surgical or other bandages; and also to or for such other purposes as the same are or may be found to be adapted: and when required, the materials may be ventilated and vulcanized.

The patentees claim, “the manufacture of the elastic fabrics as specified.”

*To PETER GERHARD VAN DER BYL, of Upper Hyde Park-gardens, for a power conserver brake, for utilizing the power expended in stopping or retarding machinery, locomotive or other engines, and vehicles of any description, when in motion,—being a communication.*—[Dated 1st October, 1862.]

THIS invention consists in constructing apparatus for stopping or retarding machinery, locomotive and other engines, carriages, trucks, vans, and vehicles of any description, used on railways or on common roads, in such a manner that the power which is expended by such stopping or retarding is accumulated or stored up by the apparatus, and given out again by the same when it is required to start the machines, engines, or vehicles again, so as to assist them in their motion.

In Plate V., fig. 1 shows a plan of the "power conserver brake," supposed to be applied to a stationary steam-engine, of which A, is the crank shaft, B, the crank, and C, part of the fly wheel. Upon the crank shaft A, are fixed two bevil wheels D, D<sup>1</sup>, capable of sliding along the crank shaft to a certain extent, but caused to revolve with the same. E, is the brake spindle, upon one end of which is fixed the bevil wheel F, whilst to the other end is attached the inner extremity of a spiral spring G, serving as the accumulator of power. The outer extremity of this spring is attached to the casing H, fixed to the engine framing, so that on the brake spindle E, being caused to revolve in the direction of the arrow, it effects the winding up of the spring, whilst the pressure of the spring, when wound up, will tend to cause the spindle to revolve in the contrary direction.

The bevil wheels D, D<sup>1</sup>, are so arranged that, by means of the levers I, I<sup>1</sup>, and J, they are alternately put in and out of gear with the bevil wheel F, upon opposite sides of the same, and to the back of the latter is fixed a ratchet wheel K, with a pawl L, worked by a lever M.

From this arrangement it will be seen that, if the crank shaft A, and fly wheel C, are caused by the engine to revolve in the direction indicated by the arrow, and it be required to stop or retard the motion of the engine, then, by putting the bevil wheel D<sup>1</sup>, in gear with the brake wheel F, this latter will be caused to revolve in the direction of the arrow; and in thereby effecting the winding up of the spiral spring G, will oppose such a resistance to the motion of the crank shaft, as to stop or retard the same to the requisite degree. If now it be required to assist in starting the engine again in the same direction, or to increase its motion, then, by putting the wheel D<sup>1</sup>, out of gear, and the wheel D, in gear with the wheel F, (the pawl L, preventing the reversed motion of the wheel F, whilst this is being effected), and then throwing the pawl L, out of gear, the accumulated power contained in the spring G, will cause the brake spindle E, and wheel F, to revolve in the direction contrary to that indicated by the arrow, and these will carry the wheel D, and, consequently, also the crank shaft A, in the direction of the arrow, being the same direction in which they revolved at first. Should it, on the other hand, be required to start the engine in the reverse direction, then the wheel D, would have to remain in gear, and the pawl L, would simply have to be thrown out of gear.

Figs. 2 and 3 show an arrangement similar to that just described; fig. 2 being a sectional elevation, and fig. 3 a plan of the same. In this case,

a bevil wheel *D*, is fixed to the fly wheel *C*, on the crank shaft *A*, of a stationary steam-engine, and the brake spindle *E*, is provided with two bevil wheels *F*, *F*<sup>1</sup>, arranged to slide upon, but revolve with, the same, being put alternately in gear with the wheel *D*, upon opposite sides of the same, by means of suitable engaging and disengaging levers, similar to those shown in fig. 1, but not shown in this arrangement. As the brake spindle *E*, has to pass over the engine shaft *A*, the bevil wheels *D*, *F*, *F*<sup>1</sup>, must be "skew bevils." Upon the brake spindle *E*, is fixed a drum or pulley *G*, upon the circumference of which one end of the rope *H*, is made fast. The other end of the rope is attached to the piston rod *I*, of the piston *J*, working, in a water-tight manner, in the metal cylinder *K*, fixed in any suitable manner. The lower extremity of this cylinder is, by preference, left open, whilst the upper end is closed and provided with a stuffing box for the piston rod *I*, and is made to communicate with a stand pipe *L*, of any required height, and of a considerably smaller diameter than the cylinder *K*. The cylinder *K*, piston rod *I*, and rope *H*, are made of such a length as to correspond with the greatest amount of motion required of the drum *G*.

By this arrangement, if the piston *J*, be at the lower extremity of the cylinder *K*, and this latter be full of water, then, assuming the engine shaft to be revolving in the direction of the arrow, and that it be required to stop or retard the motion of the same, if the bevil wheel *F*<sup>1</sup>, be put in gear with the wheel *D*, this latter will cause the brake spindle to revolve in the direction of the arrow; whereby the piston *J*, will be raised in the cylinder *K*, forcing the water contained in the same up the stand pipe *L*, the increasing column in which will cause an equivalent increasing pressure on the surface of the piston, thereby retarding or stopping the motion of the engine shaft. If, now, the wheel *F*<sup>1</sup>, be put out of gear, and the wheel *F*, be put in gear with the wheel *D*, and the pawl *M*, be liberated from the ratchet wheel *N*, then the pressure of the accumulated column of water in the stand pipe *L*, will effect the downward motion of the piston *J*; whereby the brake spindle will beca used to revolve in the reverse direction to the arrow, and will impart motion to, or accelerate the motion of, the engine shaft, in the same direction in which it moved at first.

The before-described arrangements are only applicable to engines, machinery, or carriages moving at slow speeds; as for quick speeds, the shock of putting the cog wheels in gear would be too great, and liable to cause the stripping off of the teeth. These arrangements may, however, be rendered applicable to high speeds, either by the employment of Robertson's grooved frictional gearing, instead of toothed wheels, or by making use of conical friction clutches, which are alternately put in and out of gear, which is equally applicable to the arrangement shown at fig. 1, and to that shown at figs. 2 and 3.

Figs. 5 and 6 show another arrangement for applying the principles of this invention to locomotive engines or to railway or other carriages; fig. 5 being a sectional elevation, and fig. 6 a sectional plan, of the same. *A*, is a wheel of the locomotive or carriage, to which is fixed a drum *B*, shown partly in section and partly in plan in fig. 6, and having, firstly, a groove *b*, formed upon its circumference, and carrying, secondly, a loose grooved ring *C*, capable of sliding round upon it, being kept in position by the studs *c*, working in a groove in the drum, as shown. This ring *C*,

has a pawl *D*, attached to it, which is kept in gear by the spring *d*, with the ratchet wheel *E*, fixed to the drum *B*, by which arrangement, the ring *C*, is capable of sliding upon the drum in the direction of the arrow, but must carry the drum *B*, and wheel *A*, with it when caused to revolve in the contrary direction. *F*, is the power conserver or accumulator drum, shown partly in plan and partly in section at fig. 6; which drum turns loose upon the fixed spindle *G*, carried by brackets *H*, from the framing of the carriage or locomotive *I*. Inside the drum *F*, is a strong volute spring *J*, the inner end of which is fixed to the spindle *G*, whilst the outer extremity is attached to the circumference of the drum *F*, so that if the drum is caused to revolve in the direction indicated by the arrow, the spring will be wound up, whilst, if revolved in the reverse direction, the spring will become unwound. Upon the external circumference of the drum *F*, are formed two circular grooves *f*, *f*<sup>1</sup>, corresponding in position respectively with the grooves *b*, and *c*, on the brake drum *B*; and upon one rim of the drum are formed the ratchet teeth *K*, in such a manner that when the pawl *L*, is in gear with them, the drum can only revolve in the direction of the arrow,—namely, in that direction in which the spring *J*, becomes wound up; whilst if the pawl *L*, is drawn out of gear by means of the rod or rope *M*, the drum is at liberty to revolve in the reverse direction. A rope *N*, *N*, is wound loosely round the groove *b*, of the drum *B*, and is then passed in a direct manner to the groove *f*, of the drum *F*, round which it is wound; the ends being passed through holes in the drum, and made fast to the same in any suitable manner, as shown at *x*. A second rope *O*, *O*, is wound loosely round the groove in the loose ring *C*, on the drum *B*; it is then crossed as shown, and passed round the groove *f*<sup>1</sup>, on the drum *F*, to the surface of which the ends are likewise made fast in any suitable manner, as shown at *y*. A rod *P*, capable of being moved to a certain extent vertically up and down by means of any suitable arrangement of levers, attached to the carriage or locomotive, is provided with two rollers or pulleys *Q*, *R*, so arranged that if the rod *P*, be, for example, raised, the pulley *Q*, presses upon the upper rope *N*, and in thereby tightening it, causes it to “nip” upon the drum *B*; whilst if the rod *P*, be depressed, the pulley *R*, in depressing the crossed rope *O*, *O*, tightens the same, and causes it to nip upon the ring *C*.

From the above-described arrangement it will be seen that, if the carriage or locomotive is moving in the direction of the arrow, and it be required to stop or retard its motion, then, by raising the rod *P*, the rope *N*, *N*, is caused to nip upon the drum *B*, and the rotation of this latter will then cause the rotation of the drum *F*, in the direction of the arrow, by which the spring *J*, will be wound up; and by thus opposing the motion of the carriage, will cause it eventually to stop, or will retard its speed to the required degree. As, by the motion of the drum *F*, the rope *O*, *O*, is being caused to travel round the drum *B*, in the reverse direction to that in which the latter is revolving, the rope, although loose, might thereby be caused to nip upon the drum; in which case, the ring *C*, will simply be dragged round upon the drum in the direction of the arrow, without thereby impeding its motion, in the contrary direction, to any appreciable extent. If, now, it be required to assist in starting the carriage again in the same direction in which it moved at first, or to increase its speed again, then, by depressing the rod *P*, the rope *O*, *O*, will be caused to nip upon the ring *C*; and if the pawl *L*, be now drawn out of

gear with the ratchet teeth *K*, the accumulated power contained in the wound-up spring *J*, will drag the drum *F*, round in the direction contrary to that indicated by the arrow, and will thereby effect the motion of the drum *B*, and of the wheel *A*, in the same direction in which it moved at first. If the carriage be in motion in the direction of the arrow, and the power conserver drum be not in use, then the ropes *N*, *N*, *O*, *O*, being stationary and loose, will simply slip upon the drum *B*. If the carriage be in motion in the reverse direction to that indicated by the arrow, then the rope *O*, *O*, will act as the power conserver rope, and the rope *N*, *N*, will act as the power expending rope, or the rod *P*, will have to be depressed for stopping the carriage, and raised for starting it.

Fig. 7 is a sectional elevation of another arrangement applied to carriages running upon rails or upon common roads. *A*, is the wheel of the carriage, upon the axle *B*, of which is fixed a spur wheel *C*, and a grooved pulley *D*. *E*, is a strong spiral spring, of any required length, which is held between the end of the frame piece *F*, (fixed by means of the pin *G*, and bracket *H*, to the carriage *I*), and the end of the moveable forked frame *J*, the arms of which pass through guides *f*, *f*<sup>1</sup>, formed on the fixed frame *F*. The upper and lower arms *j*, *j*<sup>1</sup>, of the frame *J*, are continued beyond the end of the frame *F*, to an extent corresponding with the length of the spring *E*, when not compressed. The upper arm *j*, is provided with a toothed rack upon its lower surface, the teeth of which correspond with those of the spur wheel *C*, and upon its upper surface it is provided with ratchet teeth, as shown. The lower fork *j*<sup>1</sup>, is formed either with a V-projection on its upper surface, as shown, corresponding with the V-groove of the pulley *D*; or the surfaces of the pulley and of the arm may be roughed, to produce the requisite friction when in contact. The arms *j*, *j*<sup>1</sup>, of the frame *J*, are carried by the slotted brake lever *K*; the upper arm *j*, sliding in grooves formed in the same, as shown in the end elevation, and the lower arm *j*<sup>1</sup>, being carried by the roller *L*, attached to the lever. The lever *K*, is capable of being moved up and down, to a small extent, by means of suitable mechanism attached to the carriage—the downward motion of the same causing the rack on the arm *j*, to be put in gear with the spur wheel *C*, whilst the upward motion draws the rack out of gear, and puts the arm *j*<sup>1</sup>, in gear with the grooved pulley *D*. The brake lever is steadied in its motion by the guide *M*, fixed to the framing of the carriage: it has attached to it a pawl *N*, which can be put in and out of gear with the ratchet teeth on the arm *j*, by means of the rope or rod *n*. The action of this apparatus will be as follows:—If the carriage be moving in the direction of the arrow, and it be desired to stop the same, then, by depressing the brake lever *K*, and thus putting the rack on the arm *j*, in gear with the spur wheel *C*, the frame *J*, will be drawn forward in the direction of the arrow, and the spring *E*, will thereby be compressed, until its resistance to further compression causes the carriage to stop, by preventing the rotation of the wheel *A*. If, now, it be required to assist in starting the carriage in the same direction again, then, by raising the lever *K*, thereby drawing the arm *j*, out of gear with the spur wheel *C*, and putting the arm *j*<sup>1</sup>, in gear with the grooved pulley *D*, and subsequently drawing the pawl *N*, out of gear with the ratchet teeth of the arm *j*, the pressure of the compressed spring *E*, will draw the frame *J*, in the contrary direction to that of the

arrow, and will thereby assist in the motion of the carriage in the same direction as at first.

The patentee claims, "the construction and employment of apparatus for stopping or retarding the motion of machinery, locomotive, or other engines, and carriages or vehicles of any description, in which the power expended in stopping or retarding such motion is accumulated or stored up by such apparatus, and is subsequently given out again by the same in such a manner as to assist in again communicating motion to, or accelerate the motion of, the machinery, locomotive or other engines, and carriages or vehicles of any description."

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*To the REVEREND HENRY MOULE, of Fordington, Dorsetshire, for improvements in locomotive engines, and in apparatus for generating steam for steam-engines.*—[Dated 29th November, 1862.]

In constructing a locomotive or other engine, the ash-pit is made water-tight, to contain water below the fire-bars. At the sides of the ash-pit openings are formed for the admission of air to the fire; over these openings slides or covers are used, in order to regulate the admission of air, and, when desired, to shut off the supply of air altogether, a steam pipe is applied between the ash-pit and the steam boiler, in order that steam may be admitted to the ash-pit. On the steam pipe is a cock or valve, by which the supply of steam to the ash-pit may be regulated or shut off. Into the ash-pit a mixture of oil, or oily or fatty matters, mixed with powdered coal, is to be introduced, and a supply of water is to be constantly kept up in the ash-pit, so as to touch the fire-bars, or to come as near thereto as may be. On the fire-bars alternate layers of coal or coke, and chalk, limestone, or lime are to be placed, sufficient to fill the fire-box to the desired height; or, the fuel and chalk, limestone or lime, may be mixed, before introducing them into the fire-box. The fire is to be lighted, air being admitted freely at the openings at the sides of the fire-box or ash-pit. When the fire is well ignited, steam may be admitted into the ash-pit from the steam boiler, and the admission of air may generally be reduced.

The figure in Plate VI. shows a section of the lower part of the fire-box of a locomotive or other engine boiler. *a*, is the lower part of the fire-box and ash-pit, which is made air and water-tight, in order that it may contain water. Above the water line are openings *b, b*, to admit air; these openings have slides *c, c*, to regulate the admission of air to the fire, and such slides are capable of closing the openings when desired. The lower part of the fire-box or ash-pit is mounted on an axis *d*, so as to admit of its being lowered when the key *e*, or other fastening used is removed; *f, f*, are fire-bars, which are preferred to be cranked downwards, so that they may be more or less in contact with the water, or only slightly above the level thereof; *g*, is a pipe, by which the supply of water to the ash-pit is kept up. A steam pipe is applied between the steam boiler and the ash-pit, in order that a supply of steam from the boiler to the ash-pit, above the water therein, may be made: on this pipe there is a cock or valve, to regulate the supply of steam and to cut it off when necessary.

The quantity of oil, or oily or greasy matter, used, and of the powdered coal mixed therewith, may be greatly varied; but one part, by



weight, of oily or greasy matter to sixteen parts, by weight, of powdered coal is a good mixture; and a quantity of this mixture is introduced into the ash-pit, and then the water is introduced, so that it may rise a few inches above the mixture. If oily matters, such as linseed, are used, such matters should be soaked in water for some hours; thus, when linseed is used, about a peck is steeped in sixty-four gallons of water for twenty-four hours, and then powdered coal is combined or mixed therewith. When the fire in the fire-box has become well lighted, the water in the ash-pit will be caused to boil, and vapours of the water, together with vapours or products from the mixture, will rise between the fire-bars. By these means a very bright fire will be produced, depending on the admission of the steam from the boiler being regulated or cut off, as may be found necessary, the admission of air being also regulated.

The patentee remarks, that he does not claim, separately, the use of limestone, chalk, or lime, with the fuel in the fire-places of steam boilers, nor does he claim the introduction of water or of steam in the ash-pits of steam boiler furnaces; but what he claims, is "the combination herein described."

*To EDWARD BROWN WILSON, of Parliament-street, for improvements in railway wheels, and in the mode of manufacturing the same.*—[Dated 5th December, 1862.]

THIS invention relates to a peculiar construction and arrangement of railway wheels, whereby greater economy and simplicity of construction are combined, with increased safety in cases of fracture of the tire.

In Plate V., fig. 1 represents, in vertical section, the improved railway wheel; and fig. 2 is a similar view of a slightly modified arrangement. A, A, are two discs of malleable metal, cast in chill moulds, and having an annular rim B, formed round their outer edges. The centres of these discs are cast with a boss C, and when the two are brought together to form a wheel, these bosses C, constitute the nave of the wheel. The tire D, is provided with an annular groove on each side, corresponding to the rims B, B, of the two discs, which fit accurately into such grooves, and are held therein by screw or cotter bolts E, or otherwise. The space F, between the two discs may be filled with any good sound deadening material. In fig. 1 the rims B, are parallel in section, and in fig. 2 they are made angular. After the discs have been cast, they may, if desired, be finished by pressing them in dies under a powerful press, or they may be rolled by a circular rolling mill.

The patentee claims, "First,—the general construction and mode of manufacturing railway wheels, as described. Second,—the constructing of railway wheels by fitting two discs, having projecting rims, into annular grooves in the tire, such discs being each cast in one piece of malleable metal, as described."

*To WILLIAM SIMPSON, of Liverpool, for improvements applicable to letter boxes and other like receptacles.*—[Dated 8th November, 1862.]

THE object of this invention is so to construct receptacles for letters and other articles as to prevent the extraction of any letters or other articles

deposited therein by the same opening through which they are introduced.

In Plate V., fig. 1 is a vertical elevation of the back of one of the improved letter boxes, with the door removed, to show the internal arrangements thereof; fig. 2 is a vertical transverse section of the same; and fig. 3 is a side elevation, with the external casing removed, to expose the levers, side plate, and so forth; fig. 4 is a vertical cross section; and fig. 5 is a longitudinal vertical section, showing a letter box fitted with the improved safety guards, with cutting edges, seen in this modification with serrated edges, but which may be constructed with a knife or other form of edge. A, is the external casing of the letter box; B, the outer casing enclosing the lever, crank, and connecting rod and sliding plate; C, a fixed plate, surrounding the port or receiving opening, which is similar to that of ordinary letter boxes; d, is a joint formed on the interior of the box, to which is attached a swinging cover D. This cover has a block piece e, which takes into and closes the opening E, through which the letters are introduced into the box. Its lower edge is bent, and forms a cutter in conjunction with a metal block F, fixed across the inside of the box immediately below the receiving opening. The block F, is constructed with a longitudinal horizontal slot, forming two cutting edges, between which the horizontal lower edge of the flap works and acts as a pair of shears for cutting twine, wire, or other like material that might be used for attempting to extract the letters or other articles deposited in the box; G, is a lever arm attached to the axle d, and actuated by the swinging cover D, and to its outer end is jointed a curved connecting link rod H, jointed to the top of the shank of a vertical sliding plate weight I, working within guides K; i, is a stud pin, on the vertical sliding plate weight, by which the cut-off plate M, is elevated to a horizontal position through a lever arm L, on the axle of the cut-off plate M, when the lower edge of the port cover is pressed sufficiently backwards by the hand, or otherwise, to be clear of the cutter block F. The plate M, has a serrated edge, and when turned horizontally up, is immediately below a transverse sloping guard N, fixed across the door or back of the box; P, is a small glazed opening in the back of the box, to enable the letters, or other articles deposited therein, to be seen, without the necessity of opening the box; Q, (figs. 4 and 5) is an ordinary swing letter-box plate; R, a transverse sloping plate, with a sharp serrated lower edge, secured to the inner surface of the front of the box, and to the back of which is jointed a swinging tilt-guard S, the lower edge of which is also formed sharp and serrated, and on the back of which is also fixed a weight T, which acts as a stock, to prevent the guard being forced too far back. This pendulous tilt-guard is so swung, that on the slightest pressure or weight of any letter or other article falling upon it, it will yield, and allow it to fall into the bottom of the box; U, is a fixed guard, extending transversely across the back of the box, the lower edge of which is also formed sharp and serrated, so as to lay hold of, and cut or prevent the withdrawal of any twine, wire, or other material inserted in the box through the receiving opening.

By the first-described arrangement, illustrated by figs. 1, 2, and 3, it will be observed that, on pushing back the swinging cover D, by pressing on the block e, the lower edge of the flap D, will be withdrawn from between the jaws of the block F, and the lever G, connected to the axle

thereof will be elevated, and carry with it the curved connecting rod *H*, and the weight plate *I*; and the stud *i*, acting on the under side of the lever *L*, will be brought up to a vertical position before the lower edge of the flap *D*, has left the jaws of the block *F*; and the swinging guard *M*, will be brought into a horizontal position, dividing the box into an upper and lower chamber, when a letter or other article may be pushed through the opening *E*. It will then fall upon the top of the tilt-plate *M*, where it will remain until the pressure on the block *e*, is removed, and the lower edge of the flap *D*, again enters the jaws of the block *F*.

In the modification, illustrated by figs. 4 and 5, it will be seen, that upon a letter or other article being inserted through the receiving opening, which resembles that of an ordinary letter box, it will slide down the guard *R*, and fall on to the upper surface of the tilt-guard *S*, which will immediately give way to the pressure, and allow it to fall to the bottom of the box, passing the fixed guard *V*, in its descent.

The patentee claims, "Firstly,—the construction and use of a flap cover for closing the receiving opening of letter boxes and other like receptacles, which, in combination with the transverse fixed block, or their mechanical equivalent, placed immediately beneath the opening for receiving letters or other articles, is so as to form a cutting instrument, as described. Secondly,—the peculiar arrangement and mode of actuating the cut-off guard flap, as described. Thirdly,—the use of fixed and moveable guards, with serrated or sharp cutting edges, as described. And, lastly,—the general arrangement, combination, and construction of the various parts of the improved receptacles for letters and other articles, substantially in the manner and for the purposes described."

To THOMAS GOULSTON GHISLIN, of Hatton-garden, for improvements in the treatment of certain foreign plants, and in the application of the fibres derived therefrom."—[Dated 10th November, 1862.]

THIS invention relates to the treatment of the following South African plants, their families and species, viz.:—*Oxalideæ*, *Hibiscus*, and other *Malvaceæ*; *Virgilia*, *Bryonia*, *Gnaphalium*, *Ficoideæ*, *Salicornia*, *Euphorbiaceæ*, *Urticeæ*, *Ficus*, *Proteaceæ*, *Cycadeæ*, *Phoenix reclinata*, *Indeæ*, including *Watsonia humilis* and others; *Gladiolus*, *Antholyza*, *Lapyrousia*, *Barbiana*, *Witsenia*, *Tritonia*, and *Sparaxis juncaceæ*, *serratus*, and *trista*; various *Restiaceæ*, *Cyperaceæ*, and *Gramineæ*; *Holcus saccharatus*, *Maize*, and *Stipa*.

By treating these plants in the way to be presently described, useful fibres, of various characters or qualities, are obtained, which may with advantage be applied to such purposes as hemp, flax, cocoa fibres, hair and whalebone have hitherto been employed for.

The leaves, fronds, or stalks of these various plants are steeped in a weak solution of alkali, and afterwards in a weak solution of sulphuric acid. Or they may be boiled in alkali, and then steeped in a cold solution of sulphuric acid, and then subjected to the friction of a rotary brush, to release the fibres from the sheaths or cuticles. The fibres are then washed well in cold water, and left to dry.

In the treatment of the plant *Trista*, the plant is cut some inches from the root, which is boiled in weak alkali, or beat out, or crushed green by

the use of rollers or beaters, thus converting it into fibrous tufts, suitable for the manufacture of brushes. The long stalk is boiled with soap or alkali until softened, and then, by suitable friction, the fibres are opened out. The fibres of the plant *Trista* cannot be conveniently cleaned by the brushing machine, as they are matted or reticulated, so that the brush cannot remove the woody matters. The best method of removing the extraneous matters from the fibres is to take up the fibres by bundles or handfuls, and submit them to a wringing operation. The fibres, when washed and curled, are used for stuffing purposes, or they may be woven into a cloth suitable for covering furniture, in lieu of hair cloth. Both portions of the plant may be either dyed or bleached, as may be desired.

By operating upon the plant when young, fibres are obtained which may be used as a substitute for flax. To this end, the fibres should be submitted to the processes of boiling and opening out, so as to produce fine fibres. They may then be either spun into yarn, or reduced to pulp for making paper.

With regard to the *Juncus serratus*, a fibrous cuticle, which grows round the web leaf, is removed from the stalk, and after submitting this cuticle to the processes above referred to, the fibres are applied to the purposes for which cotton or flax are ordinarily employed.

The tap root of this plant is utilized, and fibre obtained therefrom, by the steeping and crushing process. The web leaf of this plant may be applied as an elastic stuffing; and in order to render it suitable for this purpose, it is cut into strips and curled.

The other first-named plants, when treated as described, to effect the separation of their fibres, will form a cheap and efficient substitute, either for flax, hemp, hair, or bristles.

The patentee claims, "the mode set forth of treating or preparing the above-mentioned foreign plants, for the purpose of obtaining the useful fibres therefrom, and also the application of such fibres as substitutes for hemp, flax, or cotton, in manufacturing industry."

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To HENRY SWAN, of *Bishopsgate-street Without*, for improvements in *stereoscopic apparatus*.—[Dated 4th December, 1862.]

ACCORDING to this invention, stereoscopic pictures are combined with pieces of glass or transparent crystal of suitable form, in such manner that the pictures, which are in fact depicted on the exterior of the glass or crystal, or on surfaces placed in contact with, or at a small distance from them, shall produce an image apparently solid and imbedded in a glass or crystal. For this purpose, two prisms of glass or crystal are placed with a side or surface of the one in contact with a side or surface of the other. The prisms each have one of their angles a right angle, or nearly so, and they are so placed together that they produce a solid, having parallel sides. The stereoscopic pictures are either produced on, applied to, or placed near the adjacent sides of this solid, one picture on one prism, and the other on the other. On looking at one of the sides of the solid unoccupied by a picture, the image is seen, the light from one picture coming from it through the two prisms, and direct to one of the eyes of the observer, whilst the light from the other picture is reflected at the surfaces of the prisms which are in contact, and is thus directed

to the other eye of the observer. The picture, which is reflected before coming to the eye, will be reversed side for side by the reflection: this is compensated for by a corresponding transposition in the picture itself. The side of the prism through which the pictures are viewed is conveniently made convex: the image is then seen magnified more or less, according to the degree of convexity.

In Plate VI., fig. 1 is a transverse section of a pair of prisms, mounted in a frame covered with velvet, their longest sides being placed in contact the one with the other: one angle of each prism is a right angle, and the other two angles  $40^\circ$  and  $50^\circ$  respectively, or thereabout. One picture of the stereoscopic pair is either mounted or produced on one side of one of the prisms, as is indicated by the dotted line at A, whilst the other picture is mounted or produced on a side of the other prism, as is indicated by the dotted line at B. If the observer then looks at the side C, of the second prism, he sees the picture A, by direct vision, and the picture B, as reflected at the inclined side of the prism at D, and these images, occupying the same apparent positions, and being stereoscopic, the effect of solidity is obtained as before mentioned. The picture B, will be reversed side for side by the reflection, and allowance for this effect should be made in arranging the pictures. The prisms are mounted in a frame *a*, and they are retained in their place by a shield or mat *b*. The back of the case *c*, is made of white enamelled glass, and there is a hollow in the case at *d*, fitted with a reflector *d'*, of tin foil or white paper. In viewing the pictures, the case is held up to the light, and the light then passes in part through the white glass, the picture A, and the prisms, to the eye, and in part it passes through the white glass and falls on the reflecting surface *d'*; by this it is directed through the picture B, into the upper prism, and it is again reflected internally on striking the inclined side of the prism. This last reflection, directs this portion of the light to the eye of the observer. Figs. 2 and 3 show prisms similar to those shown at fig. 1, except that the side through which the picture is viewed is made convex, to magnify the pictures. In place of mounting the prisms, as above described, they are (more especially when of small size) conveniently mounted by surrounding the prisms on three sides with white enamelled glass or cornelian, leaving uncovered only the side through which the observer looks at the pictures.

*To ASTLEY PASTON PRICE, of Lincoln's-inn-fields, for improvements in the manufacture or production of blue colors,—being a communication.*  
—[Dated 10th December, 1862.]

IN preparing blue colors according to this invention, the patentee takes aniline combined, in any equivalent proportions, with any of the following acids, namely,—acetic, valerianic, lactic, benzoic, cinamic, tartaric, and oxalic acids, and mixes any one of these compounds with the substance known in Germany and France as fuchsine, and corresponding with those products obtained from aniline, known in this country as magenta and rosaniline. This mixture is heated, by preference, at a temperature of from  $150^\circ$  to  $190^\circ$ , until the desired blue color, free from violet, is produced. The following proportions will secure good results: To every three parts or equivalents of aniline, contained in the salts of

aniline before mentioned, add one part of fuchsine, magenta, or rosaniline, and after incorporating the mixture of these substances, place the mixture in a suitable vessel, and subject it to a temperature, varying between 150° and 190° cent., maintaining that heat until the desired blue color is produced, which is ascertained by withdrawing a portion of the fused mass from time to time, and placing the same in contact with a suitable solvent, such as alcohol. The fused mass is now to be withdrawn and allowed to cool, and it is afterwards to be washed with water, and if necessary with sulphuric or other suitable acid and water, to remove impurities from the product. The coloring matter may then be dissolved out of the residue by means of alcohol, or by any other suitable solvent, and is applicable for dyeing and printing purposes.

The patentee claims, "subjecting any of the salts of aniline before mentioned, or mixtures of the same, in combination with rosaniline, fuchsine, or magenta, to a temperature sufficiently elevated, and for a period sufficiently prolonged, to produce the desired blue color."

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*To MARTYN JOHN ROBERTS, of Crickhowell, in the County of Brecon, for improvements in means and apparatus for preparing and spinning wool, cotton, and other fibrous substances.*—[Dated 15th December, 1862.]

THE object of this invention is to obtain a better "drag" to the thread, yarn, or roving, whilst being wound on to the bobbin in preparing and spinning fibrous substances, than is usually obtained. For this purpose the flyer of a preparing or spinning frame is made somewhat in the form of a parallelogram, the lower side of which may conveniently be a circular or other shaped metallic plate, which is firmly secured to a neck or socket, and upon this socket a whorl or pulley is fixed. This socket runs upon a suitable stud or pin, which is screwed, or otherwise fastened, to a strong rail. Through the centre of the head of this flyer is placed a spindle, which passes through the bobbin, and prevents it from falling sideways. The spindle is free to turn in a hole or bearing in the head of the flyer; the lower end of the spindle is also free to turn in a cup or bearing in the stud or pin which supports the flyer and socket, or in a cup in a plate, called the "dead plate," screwed, or otherwise fastened to this stud or pin. The upper end of the spindle may be fitted with one or two projecting hooked arms, which, coming in contact with the outside of the flyer head, causes the spindle to revolve with, and at the same speed as the flyer; but it is preferred to make the spindle without the said hooked arms. The dead plate serves as a base or support for the bottom of the bobbin, and it is by the friction of the bobbin upon this dead plate, or upon appropriate washers interposed between the bobbin and plate, that the "drag" or retardation of the rotation of the bobbin is produced. When the bobbin is to be "doffed," that is, removed from its place within the flyer, the spindle is raised, and the bobbin can then be removed. The spindle not being of much greater length than the bobbin, the bobbin cannot be moved up and down the spindle for the purpose of laying the thread, yarn, or roving upon its whole length, as is done in ordinary spinning frames; therefore, to provide for the necessary operation of thus laying on the thread, a ring, or other well-known device, is used, which, while it revolves with the flyer, is traversed up and down the

flyer by a "lifter rail," upon which the ring rests, or by other convenient means. On this ring are fixed eyes or twizzles, or loops, through which the thread or yarn, coming from the delivering or front rollers of the frame, passes on to the bobbin, and consequently the up-and-down motion of the ring, with its eyes, guides the thread or yarn in a proper direction upon the bobbin.

In Plate VI., fig. 1 is a longitudinal section of a spindle and flyer, and parts connected therewith, constructed according to this invention. *a*, is a rail, to which a pin or stud *b*, is screwed by a nut *c*; *d*, is a socket or neck fixed to the flyer, and resting upon a collar or bearing *d'*, fixed to the stud *b*; *e, e*, is the flyer; *f*, is the spindle, the upper end of which revolves in a bearing or circular aperture *g*, in the flyer head, while the bottom or lower end revolves in a cup *x*, formed in the top of the stud *b*; *h, h*, is the dead plate, which is screwed on to the stud *b*, upon which plate the bobbin *i*, may rest, a cloth washer *i'*, being interposed between it and the dead plate; *j, j*, is the lifter rail, upon which a ring *k*, rests. This ring *k*, is shown detached in plan in fig. 2; it carries eyes or twizzles *l*, through which the yarn passes to the bobbin; it has also nicks *m*, cut in it, to fit over the flyer *e*, in order that the flyer, in revolving, may carry the ring round with it; *n*, is a whorl or pulley, fixed to the socket or neck *d*, and by which motion is communicated to the flyer through a driving band, in the ordinary manner.

Fig. 3 represents, in longitudinal section, a modification of the arrangement shown in fig. 1. In this modified arrangement, the stud *b*, is formed conical at top, and the socket *d*, cup-shaped, to fit over and run upon it: or this conical bearing may be reversed. The bearing surface, and consequently the friction, are much less than when the socket runs upon its base, as in the arrangement previously described. The dead plate *h*, is secured to the top of the pin *b*, by a small pin or screw, which passes through the top of the socket *d*, but in such manner as not to interfere with its rotation. The bearing *x*, for the lower end of the spindle, is formed in the dead plate *h*. Fig. 4 is an elevation, showing the spindle, fitted with two hooked arms *o, o*. These arms catch against the head of the flyer, and the spindle is thus caused to revolve with the flyer.

The patentee claims, "First,—constructing apparatus for preparing and spinning with a dead plate, acting in manner and for the purpose described. Second,—constructing such apparatus with spindles fitted, as described, and capable of running within the flyers, as described, whether connected with the flyers by hooked arms, or free. And, third,—the general arrangement and combination of the parts described."

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*To JOHN PLATT and WILLIAM RICHARDSON, both of Oldham, Lancashire, for improvements in scutchers or beaters of cotton machinery; applicable also to other machinery in which shafts are caused to revolve at high velocities.*—[Dated 20th December, 1862.]

THIS invention relates to a method of keeping the shafts of beaters or scutchers, or other rapidly revolving shafts, cool. For this purpose the shafts are formed hollow, and water is placed therein.

In Plate VI., fig. 1 represents the improvement applied to a scutcher

or beater. The shaft is at *a*, formed hollow, and partially closed at each end; small apertures only being left. The central part of the shaft is hollowed out to a greater extent than the other portions thereof, thus forming shoulders at *b*. The water being introduced through one of the apertures *c*, partially fills the chamber formed in the shaft, and as the shaft is caused to revolve rapidly, the fluid is thrown over its internal surface, and it is thus kept cool. Any vapour that may arise escapes through the apertures *c*. Instead of this arrangement, however, the water may be allowed to fill the shaft.

In fig. 2 the invention is shown, applied to a fan shaft. In this instance, the shaft *a*, is provided at each end with a stuffing-box *d*, through which stationary pipes *e*, *e*, pass. Water being admitted by one of these pipes *e*, flows out through the other, so that a constant stream is kept up.

The patentees claim, "forming such shafts, as aforesaid, hollow, and supplying water to the chambers thus formed."

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To RUDOLPH SCHOMBURG, of Onslow-terrace, Lorrimore-road, and ADOLPH BALDAMUS, of Surrey-terrace, Lorrimore-road, for improvements applicable to all kinds of oils used for illuminating purposes, whereby combustion thereof is rendered more perfect, smoke prevented, and the purity of the light increased.—[Dated 16th December, 1862.]

THIS invention consists in leading the vapor from water to all kinds of oils, while burning in lamps; whereby combustion is rendered more perfect, and the purity of the light increased. The heat generated when the wick is lighted causes the vapor of water to ascend in a hollow cone or conical chamber round the wick tube, and issue in contact with the flame about or above the point of its generation. A thin film of vapor rises from the water vessel up a narrow channel or space between two cones or conical caps with apertures, through or between which the flame passes. The water vessel is, by preference, surrounded by another vessel or chamber, between which a passage is formed, through which air passes to the flame.

The figure in Plate VI. is a longitudinal section of so much of a lamp as is necessary for showing the method of carrying out this invention. *a*, is a vessel containing water, which is admitted through the opening *b*, closed by a screwed or other stopper; *c*, is a hollow cone or conical chamber surrounding the wick tube *d*; *e*, is an inverted cup-shaped or conical vessel, placed over the cone *c*, in such a manner as to leave a narrow channel or space between it and the cone *c*; *f*, is an outer case, through which air passes to the outside of the flame. The heat from the flame causes vapor from the water in the vessel *a*, to rise through the space between the conical caps *c*, and *e*, to the flame. Atmospheric air is led to the flame through the spaces *c*, and *f*; *g*, is the support or holder for the chimney. The other parts of the lamp are of the ordinary construction. Instead of the vapor from water being generated by the flame of the lamp, it may be otherwise generated and conveyed to the flame.

The patentees claim, "leading the vapor from water to all kinds of oils while burning in lamps, in the manner and for the purposes described."

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To ALEXANDER THEOPHILUS BLAKELY, of *Montpelier-square*, for improvements in breech-loading ordnance.—[Dated 20th December, 1862.]

THE object of the first part of this invention is to effect the opening of the breech or separation of the breech-piece from the barrel by the act of firing, so that the firing of one charge will, in addition to throwing the projectile, separate the parts and leave them in the position to receive a fresh charge.

In Plate V., fig. 1 shows a side view, and fig. 2 a plan of a gun, constructed according to this part of the invention,—*a*, *a*, being the body or barrel of the gun, supported by the trunnions *a*<sup>1</sup>, *a*<sup>1</sup>, in the carriage *b*. The dotted lines *a*<sup>2</sup>, *a*<sup>2</sup>, indicate the bore of the gun: *c*, is the breech-piece, which is formed to enter the breech end of the gun. The breech-piece is affixed to, or otherwise forms part of the block *d*, which has a groove formed in each side of it, to receive the rails *e*, *e*, projecting from the end of the gun *a*, by which the block *d*, with the breech-piece, is supported, so as to be capable of sliding to and from the breech end of the gun, and in a line with the bore of it. The block *d*, has a tendency to be drawn towards the barrel of the gun by means of a weight *f*, which, in combination with springs, are connected to the block *d*, by chains *g*, *g*. One end of each of these chains is connected to the weight *f*, and thence passing over a pulley *h*, is connected at its other end to the block *d*, as shown. The weight *f*, serves also as a platform or table, for the support of the fresh charge and projectile, previous to its being driven into the gun; and, by preference, a fresh charge is placed on this table, whilst the weight of that table is holding the breech-piece in the breech end of the gun. When the parts are in the position indicated, with the table raised, that table will hold the fresh charge correctly opposite the bore of the gun. The parts, as shown, are in the position they would assume after the firing of a charge, when the effect of the recoil has been to force out the breech-piece *c*, with its block *d*; thereby overcoming the force exerted by the weight *f*. In order that the block *d*, with its breech-piece *c*, may remain in the position indicated until a fresh charge has been introduced, a pawl *i*, is applied to the weight *f*, and a rack *j*, to the framing, by which means, when the weight *f*, has been elevated, it will be held up with the fresh charge thereon, in position for loading. This charge must then be forced a short distance into the gun, and by lifting the lever handle *i*<sup>1</sup>, affixed to the pawl *i*, that click will be released from the rack *j*, when the weight *f*, will descend again and draw the breech-piece to force the charge fully into the chamber of the gun. *k*, *k*, are india-rubber or other elastic media, adapted to act as buffers, to resist the shocks produced.

Secondly, the improvements relate to mounting ordnance, to be fired through port-holes or embrasures, so that the axis of vertical motion is at or near the muzzle thereof, and at the port-holes or embrasures. As in this case the weight of the gun and its carriage will not, as is ordinarily the case, be balanced near the axis of rotation, and consequently great power will be required to move them, it is preferred to apply the power required by means of hydrostatic pressure exerted from a reservoir placed at a sufficient elevation, or by hydraulic apparatus.

To FREDERICK COLLIER BAKEWELL, of *Haverstock-terrace, Hampstead*,  
for improvements in transmitting and receiving communications by means  
of electricity.—[Dated 22nd December, 1862.]

THIS invention relates to certain improved arrangements for facilitating the transmission of autographic communications by electric telegraph.

The first improvement consists of a mode of regulating all the copying telegraph instruments on an extended system of communication, by means of a single contact breaker at the central station, so connected with sensitive electro-magnets, called "peckers" or "relays," at every station, as to make and break contact at regular short intervals, and in this manner, local voltaic batteries may be brought into action, and all the telegraph instruments be regulated to move synchronously at one uniform rate of speed. The contact breaker may be of various kinds, but the one preferred consists of a train of wheels propelled by a weight, with a regulating fan; and on to a projecting arbor of one of the wheels a small metal wheel is fixed, which is accurately divided into any required number of parts, the intervening spaces being filled with ivory, or other non-conducting substance, to form a smooth, even surface, on the circumference of which an insulated metal spring presses. The wheel and the spring being connected with a suitable voltaic battery and with the line wire, an electric current is transmitted through the wire each time that the metal surfaces touch, and it is interrupted each time that the metallic contact is broken as the wheel revolves.

Such an arrangement is shown in Plate V., fig. 1; in which *a*, represents the metallic wheel, divided on its circumference; *b*, is the insulated spring pressing upon it; *c*, is another spring that presses against the axle of the wheel to ensure metallic contact; and *d, d*, are the wires connected with the voltaic battery and with the line wire.

As the action of making and breaking contact is to be maintained continuously at the central station, the mechanism of the train of wheels must be so arranged that the contact making and breaking wheel may continue to rotate for any convenient number of hours before the impelling weight runs down. The rapidity with which the successive transmissions of electricity are made, will depend upon the speed at which the telegraph instruments are to be worked, and the number of times they require to be regulated during each revolution of the cylinder, to produce steady synchronous movements in all. About ten separate contacts, per second, is the number of successive transmissions preferred, when the cylinders make one revolution in two seconds.

The uniform synchronous movement of all the instruments in action is produced in the following manner:—The telegraph instruments are made as exactly alike as possible, and each one consists of a train of wheels propelled by a weight; accelerated velocity being prevented by the resistance of the air to a rapidly-rotating fan. On the arbor of one of the wheels, near the moving power, the cylinder is fixed, on which the messages are transmitted or received. On the arbor of the next wheel in succession, or farther removed from the moving power, as convenient, and outside the framework of the train of wheels, a light wheel, called the regulator, is fixed, having a projection on its circumference to act as a detent. The armature of an electro-magnet is suspended from a pivot, in such a manner, that the back part of it, which is covered with leather,

may bear against that projection, being pressed against it by a spring, so as to check the motion of the regulator, until the electro-magnet attracts the armature and releases the detent.

The mode of action will be seen on reference to fig. 2. *e*, is the regulator; *f*, is the projection or detent on its circumference; *g*, is the armature suspended from the pivot *h*, and drawn towards the regulator by the spring *i*, the bearing of the armature being regulated by the stop *k*, by turning the screw of which the detaining power of the armature is increased or diminished; *m*, is the electro-magnet, which is actuated by a local battery. The degree of pressure against the detent is further regulated by the screw *l*, which increases or diminishes the strength of the spring. The electro-magnet is placed so close to the armature as just to liberate the detent. The impelling weight and the size of the fan are so regulated as to produce a greater velocity than the speed at which the cylinder is intended to rotate, and the effect of the regulator, when the electro-magnet is in action, is uniformly to retard the mechanism.

Suppose, for example, the stated motion of the cylinder to be one revolution in two seconds, and that, when not retarded, it would make one revolution and a half in the same time, then, if the contact breaker brought the electro-magnet into action ten times in one second, the result of twenty successive small retardations would be a steady, continuous movement, at the rate prescribed. In adjusting the instruments, the bearing of the armature against the detent should be so regulated that the retarding action of the detent may be brought to bear at each revolution of the regulator.

The regulator, instead of having only one projecting detent, may have two, or more, at exactly equal distances apart; but, in that case, it must be attached to the arbor of a wheel nearer the cylinder, if the same rate of speed is to be maintained.

Now, suppose a governing wire, connected with the contact breaker, and through which intermittent currents of electricity were continuously transmitted, was extended from London to Glasgow, and all the intermediate stations were in connection with it,—when a message was to be sent to any one of those stations, or from one station to another, the clerk at the station to be communicated with, having received a signal through the transmitting wire, in the usual manner, would place the relay and local battery in circuit with the governing wire; and the copying telegraph instrument, when started, would be regulated by the detent on the regulator at exactly the same intervals as the instruments on any other part of the line; and if they were all placed in action, they would rotate exactly at the same rate, and synchronously. With cylinders of six inches diameter, making one revolution in two seconds, ordinary writing may be thus transmitted at the rate of upwards of seventy words per minute, and shorthand symbols at the rate of one hundred and fifty words per minute.

The invention also consists in the use of a small electro-magnet, with thick wire coils, and a very light armature, arranged as a relay, but actuated with a local voltaic battery, for the purpose of reversing the action of the electricity on passing through the message transmitted; so that the style on the receiving instrument may mark the paper when the style of the transmitting instrument passes over the varnish, and not *when it rests* upon the metal. The transmitting style is connected with

one pole of the local battery, and the cylinder with the other pole; the transmitting battery and the line wire being connected with the armature of the electro-magnet, and with the stop against which it springs back.

By this means, each time that the style rests on the metal surface of the message, the connection with the line wire is broken by the electro-magnet withdrawing the armature from the stop, and it is renewed when the style passes over the varnish writing, and the armature springs back again; and the action is thus reversed through the line wire.

The invention further consists of a means of diminishing the effect in the copying telegraph of what is called "induction," on the passage of electricity through submarine or underground wires, by reversing the direction of the electric current, or by turning it to earth. This is also effected by the use of a small electro-magnet, brought into action by a local battery, connected, in the manner before described, with the transmitting style and with the cylinder. In this case, however, a more complicated arrangement is required; and it will be best understood by reference to fig. 3. Two small pieces of platinum *n*, *o*, are attached to the ends of the light armature *p*, of the electro-magnet *m*. They are insulated from the armature and from each other, and one of them is connected with the line wire and the other with the earth. When the magnet is not in action, these pieces of platinum rest on the two stops *r*, *s*, and they are drawn against two similar stops *r'*, *s'*, when it is in action. The stops *r*, *r'*, are connected together, and are insulated from the stops *s*, *s'*, which are also connected, as shown by the dotted lines. The stops *r*, *r'*, are connected by the wire *t*, with the copper pole of the voltaic battery; and the stops *s*, *s'*, are connected by the wire *u*, with the zinc pole, or the reverse. When the armature rests upon the stops *r*, *s*, the electric current will pass from the copper pole of the battery to the earth, and be returned through the line wire to the stop *s*, and thence to the zinc pole. When the armature is drawn to the magnet, the direction of the electric current is reversed; for then the copper pole is connected with the line wire, and the zinc pole with the earth. These reversals of the electric current take place very rapidly, as the magnet is successively brought into action by the passing of the metal style over the surface of the letters. The connection of the electro-magnet with the local battery is made in the usual manner.

Another part of the invention consists in facilitating the writing of the messages to be transmitted, by using for that purpose a frosted tin foil, the surface of which, being deprived of its polish, receives the ink readily, and common writing ink, thickened with gum, may be used instead of varnish.

The patentee claims, "the arrangements of each of the distinctive parts named for effecting the objects hereinbefore specified."

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*To WILLIAM MOULD, of Belmont, near Bolton, Lancashire, for certain improvements in machinery or apparatus for plaiting or folding, and measuring fabrics.*—[Dated 30th December, 1862.]

THIS invention relates to a novel arrangement of folding machines, having two swinging concave blades or knives, placed above a reciprocating table, in the form of a segment of a circle, such table being supported in a suitable framework, and allowed to yield or fall. On each

side of the segmental table is a covered roller, which may, if required, be caused to revolve in one direction by means of the cloth being forced beneath it, and retained in such position during each repetition of the folding blades, by means of a ratchet wheel upon its end coming in contact with a pawl or catch.

In Plate VI., fig. 1 is a side elevation of the machine for folding or plaiting fabrics, showing the table and its elastic bearing, upon which the fabric is folded, and the curved blades for placing the fabric beneath the rollers, to retain the fabric in its position. Fig. 2 is a partial front view of the same. *a, a*, is the framing of the machine, and *b*, the main driving shaft supported therein; *c, c*, is the oscillating framing, within which the yielding table *d*, (in the form of a segment of a circle), and supported separately by the framing *c'*, is placed; the framing *c, c*, terminates at its lower extremity in counterbalance weights *e, e*, one on each side of the machine, and is mounted on the central shaft *f, f*, upon which it oscillates. The elastic endless band *g*, passes round this shaft, and also round the rod or bar *h*, attached to the vertical bars *c'*, by which means a constant upward and yielding pressure is imparted to the table, to retain the fabric in contact with the rollers *m, m*, during its folding. The blades *i, i*, are secured to the rods *k, k*, and are kept by means of the fingers and studs *l, l*, in the required position to place the fabric between the table and rollers *m, m*, which are covered with India-rubber; the rods *k, k*, being attached to the beams *n, n*, which are caused to vibrate on a centre in a contrary direction to the table, by means of the bell-crank lever *o*, and connecting rods *p, p*, from the crank on the main driving shaft *b*,—the oscillation of the blades being nearly uniform. The strap *q*, extends from one end of the yielding table to the other, passing beneath the rod *h*, and is pressed alternately by the bowls or rollers *r, r*, so as to depress the ends of the table, and ease the cloth from the pressure of the rollers *m, m*, whilst the blade is placing the next fold beneath them,—the bowls *r, r*, being secured upon the sliding rod *s*, actuated by the cam *t*, and driven by the spur gearing *w*.

In order that the action of the several parts may be readily understood, suppose the machine is just commencing to fold or plait the fabric, the afore-mentioned yielding table and framing is caused to oscillate by the crank and connecting rod; at the same time, and identical with, each oscillation, the swinging concave blades are brought into contact with the fabric to be folded, as shown in dots, and which passes over the guide board *u*, the blades forcing, with each oscillation, the fabric beneath the afore-mentioned rollers; giving, at the same time, a slight turn to such rollers, which are covered with India-rubber, or to which a small ratchet wheel is fixed, preventing, by means of a pawl or catch, any backward movement to such rollers, at the same time causing the fabric to be firmly retained between the rollers and yielding segmental table, and forming thereby one complete fold during each oscillation, and so repeating such oscillation until the whole piece is folded. An index for measuring the length of the folded fabric is applied to the machine, and worked by the rack and pinion *v*, as shown.

The patentee claims, "First,—the employment and use of swinging or vibrating blades, in combination with an oscillating table, for folding the fabric thereupon. Secondly,—the novel and peculiar method of suspending, by means of elastic bands, the table whereupon the fabric is folded, for

the purpose of obtaining a yielding surface. And, Thirdly,—the general construction and arrangement of apparatus for plaiting or folding, and measuring fabrics, as described."

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*To JOHN EDWARD CARTER, of Brownlow-mews, Gray's-inn-lane, for improvements in chimney tops.*—[Dated 30th December, 1862.]

THIS invention consists in constructing a top for a chimney, with angular or tapering wind guards, which partly cover in longitudinal channels, formed by bending the metal of which the shaft of a chimney top is formed.

In Plate V., fig. 1 shows an external view of a chimney pot or top, constructed and combined according to this invention; and fig. 2 is a horizontal section, taken at the dotted line 2, 2, in fig. 1. *a, a*, are angular or tapering wind guards, the larger ends of these wind guards being upwards; *b, b*, are projecting corrugations, formed in the shaft of the chimney top, leaving hollow outer channels *c, c*, between them. The wind guards *a, a*, are fixed to the projecting corrugations *b*, and partially enclose the spaces formed by the channels *c, c*. Over the upper ends of the wind guards, and over the upper end of the corrugated shaft, is fixed the cone *d*, in such manner that its lower end descends below the upper ends of the wind guards *a*, and the upper end of the channels *c, c*. Over the upper end of the cone *d*, is fixed one or more other cones *e, e*, as is shown; and over the upper end of the cone *d*, and over the cones *e*, is fixed a cylinder *f*, which is open at both of its ends.

The patentee claims, "the combination herein described."

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*To JOHN HENRY JOHNSON, of Lincoln's-inn-fields, for improvements in ingot moulds, employed in the casting of steel and other metals,—being a communication.*—[Dated 30th December, 1862.]

THIS invention consists in making moulds, to be employed in the casting of ingots of steel or other metals, syphon-shaped; the metal being first poured into a main compartment, which communicates at its lower end only with one or more other compartments by a lateral aperture or apertures; the metal rising in such other compartments slowly and steadily, although poured rapidly into the main or filling compartment.

In Plate V., fig. 1 represents a vertical section, taken through the centre of the improved ingot mould; and fig. 2 is a plan of the top of the mould. This mould is composed of four parts, *A, B, C*, and *D*, held together firmly by the key bolts *b, b'*, and comprises eleven distinct compartments or chambers; the whole of the ten chambers which surround the larger central or main chamber *a*, communicating with that chamber at their lower extremities by passages *c, c*. The upper ends of the smaller chambers are closed, with the exception of a small vent hole *d*, left therein. The entire mould is made to open or separate into four parts, in such a way that, after the ingots have been cast, they can all be easily removed from their respective chambers, the lines of division being made to pass through the whole of such chambers.

In using this mould, its parts are first bolted together, as shown, and

it is then placed on end upon a flat plate or block. The molten metal is then poured rapidly into the mouth of the central or main chamber *a*, and rises slowly in all the other chambers, entering therein by the openings *c*, at the bottom. As the central chamber rises a little higher than the rest, a slight pressure will be exerted upon the metal in the surrounding compartments, and one mouth alone requires to be covered, namely, that of the compartment or main chamber *a*. When set it is simply requisite to draw out the keys and withdraw the bolts, when the mould can be opened, and the several ingots removed.

The patentee claims, "First,—the general construction and arrangement of ingot moulds, substantially as described. Second,—the making of ingot moulds in the form of an inverted syphon, substantially as described."

*To JOHAN WILHELM HJERPE, WILHELM HOLMGREN, and ADOLPHE VICTOR SUNDSTEDT, all of Stockholm, for an improved composition or preparation of materials applicable for igniting matches.*—[Dated 20th November, 1862.]

THE object of this invention is to dispense with the use of phosphorus in the manufacture of matches, and also to prepare and apply the igniting ingredients in such a manner that matches cannot become accidentally ignited, and, in fact, cannot be ignited at all, except by being rubbed on a roughened surface specially prepared for the purpose.

The improved composition consists mainly of chlorate of potash, bichromate of potash, to which may be added a metallic oxide—such as the oxides of iron, manganese, lead, or other metal—or a metallic salt. These ingredients are mixed and incorporated with glue or other adhesive preparation, by grinding them up with the addition of a suitable quantity of pulverized glass, to form a roughened surface sufficient to produce friction.

The following are examples of the proportions of the several ingredients which will be found to effect the object of the invention:—No. 1. compound—4 to 6 parts, by weight, of chlorate of potash, 2 parts bichromate of potash, 2 parts sulphate of iron, and glue, 3 parts. No. 2 compound—4 to 6 parts, by weight, of chlorate of potash, 2 parts bichromate of potash, 2 parts peroxide of manganese or lead, and glue, 3 parts.

The quantity of pulverized glass to be introduced into these compositions is not material, as it will produce no chemical effect.

By increasing the proportion of the chlorate of potash, the matches may be made to ignite by friction on any rough surface, but for safety, it is preferable that they should only be capable of ignition by being rubbed on a surface prepared with a composition, of which some metallic sulphuret, with the addition of a metallic oxide and bichromate of potash, form the basis.

The following is an example of the proportions of the ingredients used:—From 20 to 30 parts of sulphuret of antimony; 2 to 4 parts of bichromate of potash; 3 to 6 parts of sulphate of iron; the oxide of iron or of lead, or of some other metal. These chemical substances may be mixed with 3 parts of glue; and from 2 to 3 parts of pulverized glass are to be added to produce a rough surface.

The patentees claim, "the combination of materials herein set forth, as applied to matches, and the frictional surfaces for igniting the same, whereby the advantages hereinbefore mentioned are obtained."

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To EDWARD TONYBEE, of Lincoln, for improvements in extracting oils and fatty matters from shoddy or refuse wool, skins, or skin pieces, glue pieces, cotton waste, and other animal or vegetable matter, and in producing an artificial manure.—[Dated 10th December, 1862.]

THE fibres or substances containing oils or fatty matters are to be boiled with from 20 to 50 per cent. of their weight of sulphuric acid, either in a close or open vessel, made of wood lined with lead, with or without steam, as the case may require, until the whole dissolution of the fibre or substance is accomplished. When this is completed, it will be found that the oils or fats contained in the liquid are thoroughly saponified. For the extraction of the fats or oils it is now only necessary to turn in a sufficient quantity of steam to make them rise, which will be the case in twenty-four hours or less, depending upon the greater or less fluidity of the liquor, which, of course, depends upon the quantity of water added (if any be thought necessary). The steam is admitted into the dissolving vessel by means of a leaden coil, in the ordinary way. The oils or fats taken off from the top of the dissolving vessel are then fit to go into the still, being thoroughly saponified and cleansed, ready for distillation.

It will now be necessary to turn on the steam, and, during the rapid ebullition of the liquor, add gradually, and with constant stirring, properly prepared phosphates, until such time as the whole of the free sulphuric acid remaining in the liquor is neutralized. Run off the liquid compound, which will be found to contain the whole of the nitrogen originally contained in the wool, skin, hair, and other animal or vegetable matters.

During this process there has been performed in one and the same vessel the triple operation of the dissolution of the animal matter, the saponification of the fats, and the rendering soluble of the phosphates afterwards added. By now running off the liquor into a sufficient quantity of drying material, either organic or inorganic, a highly nitrogenized and phosphatic compound is obtained, which is of great value as manure.

The following is a convenient manner in which to conduct the process:—Take, say five tons of skin pieces or woollen shoddy, or other organic substance containing oil or fatty matter, and place one-half of the same in a leaden or other vessel, either open at the top or closed, if desired, and add to them, say, one ton of brown or concentrated sulphuric acid, by means of which the skin pieces are dissolved, and the fats contained are liberated, and at one and the same time converted into acid fats, proper for distillation. As soon as the half, more or less, is dissolved, add gradually the remainder of the material, in small quantities, until as much as possible is dissolved with the acid. When this is fulfilled, and the acid is partially neutralized, blow up with steam of about 2 to 3 atmospheres' pressure, quietly and for twenty-four hours, which effects a complete separation of the acid fats and the disintegrated organic matter, let it be whatever it may; the fats coming to the top perfectly free from glycerine, &c., thoroughly cleansed and fit for distillation; whilst



the dissolved organic matter, with an admixture of sulphuric acid, is beneath, totally disintegrated and perfectly liquid. Next skim off the fats, place them in a still, and distil the combination in the usual way, separating the stearic from the other fats by means of pressure, as is always done. As regards the nitrogenous liquid compound underneath, after the removal of the fats, add, in the same vessel, a quantity of finely-ground phosphate of lime, boiling now with free steam, until such phosphates are rendered entirely soluble, and the sulphuric acid contained is neutralized; by this means is produced one of the very best nitrogenized fertilizers from the matters, which, up to this time, have been considered of little value; at the same time there is recovered from 10 to 15 per cent. of fats, which heretofore have only been recovered by expensive and complicated processes.

*To THOMAS EDWARD VICKERS, of Sheffield, for improvements in the construction of ordnance.*—[Dated 11th December, 1862.]

THIS invention relates to a novel mode of annealing and cooling blocks of steel or iron, or any other metal or alloy, of which it is proposed to construct a gun or other piece of ordnance.

The object of the invention is to cool the block of metal in such a manner as to cause that portion of its section which is nearest to the inside of the bore to contract first, the other portions of the section being allowed to cool upon it, in the order of their respective distances from the axis of the piece.

In Plate V., fig. 1 represents a transverse section of the breech of a gun, cast or otherwise, formed in a solid block in any convenient and well-known manner; the solid block being supposed to consist of a solid core 1, and three concentric rings of metal 2, 3, 4, thereby forming one solid mass. The first operation will consist of boring out the central part or core of the gun of something less than the required calibre; or, if desired, the gun may be cast with a hollow core, as shown in fig. 2, and then afterwards bored out to the desired calibre, if required. This having been done, the block is to be re-heated, and gradually cooled in an annealing furnace, by the introduction of a stream or jet of water: the cooling operation is thus carried on from the inside towards the circumference, as indicated by the concentric rings. It will now be understood that the ring 2, will be cooled before the ring 3, and the latter before the ring 4, or outermost ring, and consequently 4 will shrink on 3, and 3 on 2, thereby greatly increasing the strength of the gun. The operation of cooling a mass of metal from the inside, by causing a stream of water, air, or other suitable liquid or fluid to pass continually through, is well known; it will, therefore, be understood, that the essential feature of novelty in the present invention, in contradistinction to that of cooling molten metal from the inside of the block, as now practised, consists in boring, re-heating, and cooling from the inside metal gun blocks, made either by casting, rolling, or forging the same, or of re-heating and cooling from the inside gun blocks that have been made with a hollow core.

The patentee claims, "the boring, re-heating, and cooling from the inside gun blocks, made from cast or other metal or alloy, and particularly the application of the process of cooling from the inside after the gun has

been bored out and re-heated. Also, making cast-steel guns without mechanical compression, by casting them with a hollow core, and after re-heating, annealing, and cooling them from the inside, as set forth."

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To WILLIAM BRIDGES ADAMS, of Hampstead, for improvements in railways and tramways.—[Dated 31st December, 1862.]

IN Plate VI., fig. 1 shows, in section, an improved channel sleeper, which may be of wrought or cast iron. *a*, is the rail; *b, b*, the horizontal surface of the sleeper, which is about the mid-height of the channel. The length of the sleeper is about two feet, more or less, and the rail, which has a large table above and a small one below, rests on the tops of the sleeper channel, with its rebated edges at *c, c*; a projection of the vertical web on either side keeping the rail in lateral position with the sleeper: the channels on each side the rail web serving to apply fishes, if required. One, two, or more round iron keys *d*, tapered to a point, to enter easily, are driven through the two sides of the sleeper channel and the rail web, in the mode commonly known as "draw bore," and hold the rail firmly. These sleepers are placed at intervals, or close to each other, along the line of rail, and each pair, or each alternate pair, are connected together and to the opposite rails, by an angle-iron tie bar *e*, to form the gauge. A boss is formed round a hole on the lower side of the sleeper, on which the upper edge of the tie bar is notched. A bolt *f*, with one end bent into a hook, which passes into a hole in the horizontal web of the tie bar, secures it to the sleeper with the right pitch for the rail. The dotted lines *g*, below the sleeper, show how a keel may be formed to hold into the ballast. Fig. 1<sup>a</sup> shows, in section, the rail *a*, and a pair of fishes *h, h*, (deepest in the middle to strengthen the joint,) to apply to the rail joints, the upper edges of the fishes bearing on the rebate of the rail top, and with internal ribs *i, i*, below to take the rail table.

Fig. 2 shows a similar arrangement with a double-headed rail *a*, and the upper lips *c, c*, of the sleepers *b, b*, turned inwards for the rail to rest on. This rail, like fig. 1, is suspended from the upper table, but, like that, it may bear on the bottom, or on both bottom and top. The rail, in fig. 2, must be passed endwise into the sleeper. The dotted lines *g, g*, show how it may be keyed into the ballast. The tie bar *e*, and bolt *f*, and round keys *d*, are similar to fig. 1. Fig. 2<sup>a</sup> shows the rail *a*, with the fishes in section. The outer fish is about  $\frac{3}{4}$ -in. thick, and is of an arched form; increasing in width in the middle nearly to the depth of the rail, with a pair of internal wedge ribs *h, h*. The inner fish has two internal ribs *i, i*, on the arched plate, and a lower flange *j*, tapered at the end, and deep in the middle to the bottom of the rail. As the bolts tighten, the arch plates flatten and press firmly against the rail tables, the heads of the bolts inside being prevented from turning round by the projection of the flange; an elastic fit is thus produced, and the fishes keep tight. These fishes can be manufactured by stamping or pressing, or rolling and shearing; and by the increased depth of the fishes, the joints of the rails are prevented from deflecting. The dotted lines at fig. 2<sup>a</sup> show how these fishes may be formed into brackets with bases.

Fig. 3 shows a similar kind of channel sleeper for a double-headed rail, so formed that the rail will enter from above and rest on the edge of the inner upper lip *a*, suspended, though it may also bear on the bottom. To keep it in position, pieces of wood or iron *b*, in one or more lengths, are placed in the outer side channel of the rail, and taper screws *c*, are turned in between these filling pieces and the outer jaw of the sleeper; for which purpose, the jaw of the sleeper may be formed in grooves forming screw threads, so that the screw may be placed at any part of the length: the tie bar is similar to figs. 1 and 2. The horizontal bearing flanges of figs. 1, 2, and 3, may be placed higher or lower on the sleeper channel, to suit convenience, and the higher they are placed the easier will the sleeper be packed, and the less will it be disposed to rock by the action of the trains; but as it might be subject to lift vertically, that may be prevented by lower flanges keying into the ballast, as indicated at *g, g*, figs. 1 and 2.

Fig. 4 shows, in section, a rail *a*, with angle brackets *b, c*, applied laterally in the rail channels, and bolted to and through the rail. Angle brackets have before been used with rails called girder rails, both continuous and detached in short lengths, but it was needful to have rails of great extra depth in the heads in order to clear the wheel flanges, as the bearings on the ballast, both inside the rail and out, were on the surface; but, in the present case, a new arrangement is made by turning the bearing of the inner angle iron *b*, downwards, and that of the outer angle *c*, upwards, and so bolting them; by which means, the ordinary rail may be used. The tie bar *d*, is shown below fastened by the hook bolt, and the angle irons may be, in any convenient lengths, continuous or detached.

Fig. 5 shows, in section, a shallow rail, with a bottom flange like a contractor's rail, but with a dovetail rib *a*, rolled below: a pair of angle irons *b, b*, are rolled to clip this dovetail. Where they join at the vertical webs below the dovetail they are bevelled below, and two square or oblong washers *c, c*, through which the bolt *d*, passes, are bevelled to fit them. As the bolts tighten, a wedging action takes place, and all the parts are clipped firmly together. The tie bar *e*, is cranked at the end, to take the bolt head. The angle irons break joint with each other in any convenient lengths: the dotted lines below *f, f*, indicate how the angle irons may be flanged out to key into the ballast.

Fig. 6 shows, in section, one of the girder base plates *a*, with a keel below, and an ordinary chair *b*, with a rail placed in it. The girder or keel plate *a*, may be of wrought or cast iron, in lengths of two feet, more or less; it is bolted on one side at *c*, and the hook bolt *d*, with the tie bar, takes the opposite side of the chair and sleeper. In all the plans, from fig. 1 to 6 inclusive, it will be seen that the principle of a keel, descending below the bearing surface on the ballast, is used.

Fig. 7 shows, in section, a mode of bolting diagonal timbers laterally to a double-headed rail, with horizontal flanges below the heads. Fig. 7<sup>a</sup> shows the mode of applying deep parallel fishes to the rail with the ends thickened, and wedging in between the tables and flanges.

Fig. 8 shows, in section, an arrangement of diagonal timbers bolted through the rail channels, so that an ordinary rail may be used, with clearance for the wheel flanges; the dotted lines below indicate how the timbers may be deepened. Flat or square timbers have heretofore been

used, but such timbers, so bolted to ordinary rails, have, however, been cut to pieces by the wheel flanges, which difficulty is avoided by the diagonal form.

A modification of the above arrangement may be made by bolting the diagonal timbers below the rail.

The invention also consists in forming elastic bases for the rails to rest on, so as to prevent the effect of blows, caused by rails striking chairs, and chairs striking sleepers, and sleepers striking ballast, which hardens by constant percussion.

One method is shown at fig. 9, as a chair *b*, of peculiar form, with an enlarged internal base, in which are placed two or more plates of tempered steel *c*, on which the rail rests transversely; and there is room between the top of the chair and the rail table for the rail to descend as the springs play under pressure of the wheels: a hollow space below the spring serves for the same purpose. The springs are five to six inches long, and three to five inches wide. The wood key *d*, is faced with an inner plate, to prevent wear with the side of the rail, and the lower edge presses on the spring plates, to keep them down: spring plates of various forms may be used.

The invention further relates to the use of tempered steel plates *b*, overlying the central hollow of a keel base plate, and intended for the rail to rest on. The rail is kept in position by a pair of brackets, bolted down to the base plate and pressing on the upper side of the lower table of the rail; one bolt being a hook bolt which takes the tie bar. The springs enter hollows of the brackets at the ends, and the brackets may be shaped to take the sleeper hollow, with projecting edges outside the springs to keep them firmer.

Fig. 10 shows a pair of sleeper castings bolted together to form a sleeper; the lower parts *a*, *a*, having side lips to key them down in the ballast. The bolts *b*, which may be two or more, pass through from side to side below the hollow, over which the springs *c*, lie. The castings are about two feet long, and the upper parts *d*, *d*, which clip the rail, may be of the same length, or shorter. The nut of the bolt *b*, is recessed in the sleeper, so as not to turn, and the head has a collar and square neck beyond it, to turn it by. The bolts may also, if preferred, pass below the bearing flanges: the tie bar and bolt are as before described at fig. 1.

Fig. 11 shows a side view, with one side removed to show the section of a cast-iron sleeper *a*. The rail is shown in section at *b*; the brackets *c*, *c*, abutting against the ribs *d*, *d*, on the sleeper top *e*, on flat springs, on which the rail rests, over a hollow space below. *f*, *f*, are bolts, hooked below, and passing into holes on the angle-iron tie bar *g*. A space is left between the rail and the tops of the brackets for the play of the rail. The size of the springs may vary from six inches long to five or six inches wide, or more or less, and about a quarter of an inch in thickness; varying according to the load on the wheels.

A similar rail and sleeper may be employed, having springs for the rail to rest on, curved upwards lengthwise with the rail, and abutting at their ends against recesses in the sleeper. If preferred, however, the curvature of the springs may be transverse to the rail; or they may be curved downwards instead of upwards, or they may be square, or circular plates supported all round, either rising in the centre or with a boss placed on them, to support the rail.

Fig. 12 shows a deep channelled sleeper *b, b*, two feet long, more or less, with springs *e*, below for the rail *a*, to rest on: these springs may be flat or arched, or bearing against abutments at the ends. The rail *a*, is supported laterally by pieces of wood or metal *d, d*, fitting the side channels, either in detached pieces or the whole length of the sleeper. If of wood, they should be lined with iron, to prevent wear against the rail. Holes are formed in the sleeper, rail, and channel pieces, and a tapered key or keys *c*, is driven through all "draw bore," as before described at fig. 1, but below the bearers. The hook bolts and tie bar are as before described, except that the nut is recessed into the top of the sleeper, to be out of the way of the wheel flanges.

Fig. 13 shows a sleeper *b, b*, with horizontal bearers, with the jaws pressing against the web of the rail *a*, but with space between the tops of the jaws and the rail table. The sleeper is spread out wide below for the springs *e*, on which the rail rests, with a hollow below, and is fastened down by the lower jaws of the sleeper: the rail enters the sleepers endwise.

Fig. 14 shows, in section, a cast-iron sleeper, of the hollow bowl kind. A solid jaw *a*, is cast over the sleeper on one side, wide at the base, to admit the spring plates on which the rail rests. A bracket jaw *b*, abutting against a rib *c*, is bolted down, and holds the rail in position while it can follow the springs in their deflection.

Fig. 15 shows, in side view, another method of obtaining elastic action for rails, equable and continuous throughout. *a, a, a, a*, show the ends of cross sleepers, of the ordinary kind, bedded in ballast; *b*, a longitudinal timber, which may be of the same scantling as the cross sleepers, or larger; the joints of the longitudinals being placed at the middle of a cross sleeper and trenailed or bolted down, so as to form a large framing. On these longitudinal timbers ordinary chairs *c, c, c*, are fixed immediately between the cross sleepers, and the rails are keyed in in the usual way; so that this rail does not come in contact with the longitudinal timber, but only the chairs. The cross sleepers are firmly packed in the ballast, but the longitudinals are not packed, but are hollow below: in this mode the longitudinals form a continuous elastic base for the chairs and rails. Brackets, or diagonally cut timbers, may be used instead of chairs, and the cross sleepers, being fast to the longitudinals, do not roll fore and aft in the ballast. In this mode the pressure of the wheel is always distributed over two or more sleepers, and is never on a single sleeper, as is the case in the ordinary non-elastic method.

Fig. 16 shows a rail bolted between two diagonal timbers, similar to fig. 8: cross blocks *a, a, a*, connect it with the elastic base *b*. Another set of blocks *c, c, c, c*, support the elastic base on stone sleepers *d, d, d, d*; thus the timber may be kept out of the ground, and the stone blocks may be bedded in concrete, and ordinary ballast be dispensed with.

Fig. 17 shows a foot rail *a*, without chairs, fixed on blocks *b, b, b*, on the elastic base *c*, which bears on sleepers *d, d, d, d*, which are transverse iron troughs, similar to fig. 11, packed at the ends or through surface holes. The bearings of the rail are intermediate to the sleepers.

Double-headed rails may also be bolted between brackets fastened to an elastic base plate of ribbed iron, one rib being at the middle, or one at each end. The base plate is fixed on iron trough sleepers.

Fig. 18 shows, in section, a rail *a*, applied with brackets *b, b*, on an

elastic timber base. This figure shows the rail sufficiently elevated not to bear on the timber base.

Fig. 19 shows two longitudinal bases *a*, and *b*, connected to opposite longitudinals by cross ties *c*, *c*, *c*, *c*, all being trenailed together. The rail *d*, is enclosed in diagonal timber, as seen in section at fig. 8, and is spiked down on blocks *f*, *f*, *f*, interspaced between the cross ties *c*, *c*, *c*, *c*. The lower longitudinal *a*, and the cross ties *c*, *c*, *c*, *c*, are packed firm in the ballast: the upper longitudinal *b*, is left as an elastic base to the rails and blocks *f*, *f*, *f*.

Fig. 20 shows a hollow cast-iron sleeper *a*, of square or round pyramidal form with vertical edges below, and with surface holes for packing if required. Between the ribs *b*, *b*, on the top, is placed an elastic timber base *d*, shown endwise, and bolted down to it.

The patentee claims, "the form of rail shown at fig. 1, with the fishes, fig. 1<sup>a</sup>, and the channel sleepers, shown at figs. 1, 2, 3, 12, and 13, with the taper screw and side key; and the fishes and brackets 2<sup>a</sup>, 2<sup>b</sup>, and the tie bars with hook bolts. Also, the system of angle brackets, figs. 4 and 5, and the arrangement of rail and fishes, and diagonal timbers, figs. 7 and 7<sup>a</sup>; the arrangement of diagonal timbers, fig. 8, and the fishes and brackets to foot rails. Also, the spring chair and metal-faced key, fig. 9. Also, the keel sleepers, brackets, springs, and tie bar; and the sleepers in two halves, with springs and collar bolts, and recessed nut, fig. 10. Also, the trough and box sleepers, figs. 11, 14, 17, and 20. Also, the arrangement of timber elastic bases, as shown at figs. 15, 16, 17, 18, 19, and 20. And, also, the arrangement of springs in chairs, brackets, and sleepers, as described."

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To WILLIAM EDWARD NEWTON, of 66 Chancery-lane, for improvements in the couplings for railway carriages,—being a communication.—  
[Dated 30th January, 1863.]

IN Plate V., fig. 1 shows, in longitudinal section, two coupling boxes, constructed and connected according to this invention; and figs. 2 and 3 are top views of portions of coupling bars. *A*, *A*, are the coupling boxes; *B*, is the coupling bar; *C*, the tumblers or latch; *D*, spiral springs; *E*, the front or open end of the coupling box; *F*, a box through which the rod of the tumbler slides, and into which the springs *D*, recede, when the tumbler *C*, is drawn up to permit the withdrawing of the coupling bar *B*. *G*, is the cavity of the coupling boxes; *H*, is a perforation made through each coupling box, in order that the cars may be coupled by ordinary links and pins, when desired; *O*, is a strap, which is bolted to the under framework of the car, and which supports the coupling box. *I*, is a spring box (one for each coupling box), enclosing an India-rubber spring *K*. The box *I*, is secured to the under frame-work of the car by bolts *L*. A rod *M*, passes through the India-rubber spring *K*, being attached to the rear end of the coupling box by a bolt or pin *N*. *P*, *P*, are cross pieces, fastened to the rod *M*, and alternately press upon the India-rubber *K*, as the car is drawn forwards or pushed backwards. The tumbler *C*, it will be seen, moves in a vertical line, being provided with tongues *C'*, which slide in corresponding grooves *a*, *a*, in the sides of the coupling box. The side of the tumbler *C*, which faces, and comes in contact with, the detent *d*, of the coupling bar, is very slightly

bevelled from top to bottom. This arrangement and mode of construction enables any operator to uncouple the cars at any time, without starting the train backwards or forwards, no matter how close may be the contact between the tumbler and the coupling bar. When two cars are to be coupled, the coupling bar B, having had one of its ends inserted into the coupling box of either car, is kept in a position (about horizontal) by the tumbler and its springs. On one car standing still, and the other approaching it, the outer end of the coupling bar comes in contact with the tumbler in the coupling box of the approaching car; which tumbler, being kept down by its springs, arrests the further entering of the bar, until the latter, having been pushed back by the continued motion of the approaching car, the inserted end of the bar strikes the rear wall of the cavity G, and the outer end of the bar at once raises and passes under the tumbler, with which it is in contact. The tumbler immediately assumes the position shown, and the cars will then be coupled. The coupling bar B, is made shorter than the combined length of the two cavities G, when the front ends E, of the coupling boxes are in contact, and therefore the bar cannot strike at the same time the rear walls of both the cavities.

The coupling bars are constructed in two forms, each having expansions  $b$ ,  $b^1$ , (figs. 2 and 3). Each form is designed for a particular office. The expansions  $b$ , of the bar, represented in fig. 2, extend laterally outside the detent  $d$ . A bar of this form is used to connect the train to the engine, and whenever it happens that the engine is thrown from the track, it is very desirable that the connection between the engine and the train should be speedily broken.

By using a coupling bar, such as is shown in fig. 2, when the engine leaves the rails, as long as the engine wheels remain on the cross ties, and the engine is so kept in about a horizontal position, the couplings will not come undone; but, as soon as the wheels on one side of the engine leave the cross ties, and the engine is thereby canted over, the expansion  $b$ , of itself will raise the tumbler  $c$ , and uncouple the engine from the train, and the latter will be left on the track. In the bar represented in fig. 3, the expansions  $b^1$ , have less prominence than those on the bar represented in fig. 2, the detent  $d$ , extending outside of the expansions. This form is used for connecting the cars which compose the train. Bars thus constructed do not of themselves uncouple the cars, but it requires the tumbler  $c$ , to be drawn up before the uncoupling is effected. The flat ends of the bars obviate the tendency that a round bar has to turn over—a result which might endanger the uncoupling of the cars when not desired.

The patentee claims, "Firstly,—the combination of the tumbler  $c$ , springs  $d$ , and grooves  $a$ ,  $a$ , as described, whereby operators are enabled to uncouple the cars without moving the train backwards or forwards. Secondly,—the employment of coupling bars, such as those shown in fig. 2, having expansions  $b$ , near the ends of the bars, which expansions of themselves uncouple the cars, in case the latter get off the track. Thirdly,—the employment of coupling bars, such as those shown in fig. 3, having expansions  $b^1$ , near the ends of the bars, which expansions have less prominence than the detent, so that, although one or more cars of the train may get off the track the cars shall not be thereby uncoupled."

To JOHN ROBERT BRECKON, of *Darlington*, and THOMAS DOUGLAS, of *Pease's West Colliery, Crook*, both in the County of Durham, for improvements in the manufacture of fire-bricks and other articles usually made from fire-clay.—[Dated 11th December, 1862.]

THIS invention consists in manufacturing fire-bricks and other articles (usually made from fire-clay) of the fire-stone called ganister, as it is found in the coal-fields in the counties of Durham and Northumberland, combined with the ordinary fire-clays as they are obtained from the coal measures of the two aforesaid counties.

From four to five parts of pulverised ganister, mixed with one part of ground fire-clay, affords excellent results, and fire-bricks, and other articles manufactured from the above materials, in the proportions given, resist the action of heat more completely, and are more durable than those manufactured in the ordinary manner. The patentees do not, however, confine themselves to these exact proportions, as they may be varied at pleasure, according as the fire-bricks or other refractory articles are required to be dense and close grained, or open, porous, and siliceous.

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To JAMES JONES, of *Rhodes, near Middleton, Lancashire*, for improvements in finishing or stiffening textile fabrics.—[Dated 1st January, 1863.]

HERETOFORE, in applying size, starch, or stiffening fluid to textile fabrics, it has been usual to pass such fabrics between two plain or smooth rollers in contact, or to pass them between an engraved roller and a plain roller, wrapped or covered with blanket, as in ordinary machine printing; and in each case the use of one of the rollers has been to press the size, starch, or stiffening fluid into or upon the fabric; and in each case the textile fabric has been moved by and between the rollers employed at the surface speed of the rollers.

Now, according to the present invention, the roller employed to apply the size to a textile fabric is caused to move in opposition to the fabric, which, in passing the roller, comes in contact with a small arc of the surface of the roller, by which the fabric receives the size from the surface of the roller, and is thereby stiffened, without requiring the use of the ordinary pressing roller or cylinder, with its back cloth and appurtenances.

In carrying out the invention, it is preferred to employ rollers engraved in the following manner:—They are engraved in pinned diagonal lines, as is sometimes used for padding rollers, but instead of the diagonal lines running the whole length of a roller in the same direction, they incline from the middle of a roller to the two ends thereof, in opposite directions; so that one half of the engraved lines incline in one direction, and the other half incline in the opposite direction to the axis of the roller. Each alternate line of the two sets of diagonal lines is carried forward for about half an inch into the other set; it is found that this is desirable, in order to stiffen that portion of the fabrics which passes over the roller at the joining of the lines. By reason of a roller being thus engraved and caused to move in opposition to the fabric, there will



be a tendency to stretch the fabric laterally when spreading the size on to the surface of a passing textile fabric. The engraved roller may revolve, partly immersed in the stiffening fluid, or be supplied by another roller in the stiffening fluid. A doctor, or other suitable instrument, is employed, as is well understood, with the engraved roller, so as to remove any excess of the stiffening fluid from its surface.

It may be stated, in reference to the surface speed of the roller, as compared with that of the fabric, when the roller is moving in the reverse direction to the fabric, that the surface of the roller should move at about the same rate as that at which the cloth is passing over it; for instance, for every yard the cloth moves in one direction, the surface of the roller moves a yard in the other direction. This can, however, be varied if it be desired to put more or less starch or stiffening fluid into a fabric.

*To WILLIAM HENRY MUNTZ, of Millbrook, Hants, for an improved method of attaching sheathing to iron or other vessels.*—[Dated 2nd January, 1863.]

THIS invention is designed principally with a view of attaching sheathing of "yellow metal" or "Muntz's metal" to iron sea-going vessels, but it is also capable of being applied with advantage for attaching such or any other sheathing to vessels built of other materials.

It has long been well known that the yellow metal sheathing is the most durable, and keeps clean longer than any other; but in attaching such sheathing to iron ships, it has been found in practice that, owing to the contact of the two metals in the salt water, a strong galvanic action has taken place, so as to decompose and ultimately destroy the sheathing metal and the iron.

In order to obviate this defect, it has been proposed to insulate the two metals, by placing sheets of vulcanized India-rubber or other material between them; and various methods have, from time to time, been devised for attaching the sheathing without forming any metallic connection between it and the iron plates of the vessels, such as the use of ebonite rivets, or drilling holes in the iron plates, plugging them with wood and nailing the metal sheathing thereto, both of which plans are open to objection, on account of the weakening of the iron plates, consequent upon drilling so many holes therein; also, on account of the expense, and various other reasons.

Now, the invention consists in attaching the sheets of India-rubber or other insulating or "anti-galvanic" material to the vessel's side, and the metal sheathing to the insulating material, by means of marine glue, or such other cement or adhesive material as will resist the action of sea water, instead of nailing or riveting the same, as previously practised or proposed.

The patentee either employs the waterproof glue or cement, both for attaching the India-rubber or other impervious insulating material to the sheathing, and also for attaching the same to the ship's side; or he attaches the India-rubber to the metal sheathing by heat and pressure only during the process of vulcanization, as is well understood, and uses the *waterproof glue* or cement only for attaching the same to the ship's side.

He claims, "Firstly,—attaching metallic sheathing to iron or other vessels by means of waterproof glue or cement, combined with the interposition of sheets of vulcanized India-rubber between the ship's side and the metal sheathing; or of such other impervious insulating material as will prevent any galvanic action taking place. And, Secondly,—attaching such sheathing to wooden vessels by means of the waterproof glue or cement only, without the interposition of any other material."

## Scientific Notices.

### INSTITUTION OF MECHANICAL ENGINEERS.

(Continued from page 106.)

"On double-cylinder pumping engines," by MR. DAVID THOMPSON, of London.

THE double-cylinder pumping engines, referred to in the previous paper by Mr. Pole as having been erected by Messrs. Simpson, at the Lambeth Water Works, Thames Ditton, were designed and executed under the superintendence of the author of the present paper, in which it is intended to give a general description of the engines, with a few practical remarks suggested by the experience of their performance.

These engines are beam engines, having the double cylinders at one end of the beam, and a crank and connecting rod at the other end: four engines of 150 horse-power each are fixed side by side, arranged in two pairs, each pair working on to one shaft, with cranks at right angles, and a fly-wheel between them. The strokes of the crank, and of the large cylinder, are equal; while the small cylinder, which receives the steam direct from the boiler, has a shorter stroke, and its effective capacity is nearly one-fourth that of the large cylinder. The pumps are connected direct to the beams near the connecting-rod end by means of two side rods, between which the crank works. The pumps are of the combined plunger and bucket construction, and are thus double acting, although having only two valves. The author believes that this kind of pump, which is now in general use, was first introduced by him at the Richmond and Bristol Water-works, in the year 1848. The following are the principal dimensions of the engines:—

|                                        |     |     |     |     |                            |
|----------------------------------------|-----|-----|-----|-----|----------------------------|
| Diameter of large cylinder             | ... | ... | ... | ... | 46 in.                     |
| "    small cylinder                    | ... | ... | ... | ... | 28 in.                     |
| Stroke of large cylinder               | ... | ... | ... | ... | 8 ft. 0 in.                |
| "    small cylinder                    | ... | ... | ... | ... | 5 ft. 6 $\frac{3}{4}$ in.  |
| Diameter of pump barrel                | ... | ... | ... | ... | 23 $\frac{3}{4}$ in.       |
| "    pump plunger                      | ... | ... | ... | ... | 16 $\frac{1}{2}$ in.       |
| Stroke of pump                         | ... | ... | ... | ... | 6 ft. 11 $\frac{3}{4}$ in. |
| Length of beam between extreme centres | ... | ... | ... | ... | 26 ft. 6 in.               |
| Height of beam centre from floor       | ... | ... | ... | ... | 21 ft. 4 in.               |

The principal peculiarity of these engines is in the valves and valve gear. The valves are so constructed that one valve effects the distribution of the steam in each pair of cylinders. The valve consists of four small pistons, fourteen inches diameter, connected together by a pipe, which forms the passage for conveying the steam from one end of the small cylinder to the opposite end of the large cylinder. The steam from the boiler enters the annular space surrounding the middle of the valve; and the communication with the condenser beyond the top and bottom ends of the valve. With the valve in its lowest position, the steam from the boiler is admitted into the bottom of the small cylinder, for making the up-stroke; and the steam from the top of the small cylinder is exhausted through the hollow pipe of the valve into the bottom of the large cylinder, while the top of the large cylinder exhausts direct into the condenser, beyond the top end of the valve.

The cylinder ports are rectangular, with inclined bars across the faces, to prevent the packing rings of the valve from catching against the edges of the ports; and the bars are made inclined, instead of vertical, in order to avoid any tendency to grooving the valve packing. The openings of the port extend two-thirds round the circumference of the valve in the ports of the large cylinder; but they extend only half round in the ports of the small cylinder. The packing of the valve consists of the four cast-iron rings, which are cut at one side, exactly as in an ordinary piston, the joint being covered by a plate inside. A considerably stronger pressure of the rings against the valve chest is required than was at first expected, because the openings of the steam ports extend so far round the valve; and for this purpose springs are placed inside the packing rings, to assist their own elasticity. This construction of valve has the advantage of admitting of great simplicity in the castings of the cylinders; and also allows of the whole of the valve work being executed in the lathe, which is generally both the cheapest and most correct kind of work in an engineering workshop. These valves are worked by cams, which are not well adapted for engines working at high speed; and this led the author, in the construction of some recent double-cylinder engines, to adopt valves and valve gear of a different construction; but he has not been able to design any which surpass, or even equal, these, in the economical distribution of the steam.

The principal object aimed at in the construction of this piston valve was the reduction to a minimum of the loss of pressure which the steam undergoes in passing from the small cylinder to the large one. This is here accomplished by making the passage of moderate dimensions, and as direct as possible; and also by preventing any communication of this passage with the condenser; so that when the steam from the small cylinder enters the passage, the latter is already filled with steam, of the density that existed in the large cylinder at the termination of the previous stroke. In constructing the engines, some doubt was entertained as to the best size of passage, in order, on the one hand, to avoid throttling the steam, and on the other to obviate as much as possible the loss of steam in filling the passage. The size adopted was a pipe 6 inches in diameter, or 1-60th of the area of the large cylinder, for a speed of piston of 230 feet per minute in the large cylinder; and this is believed to be about the best proportion, the

entire cubic content of the whole passage in the valve amounting to 3944 cubic inches. Indicator diagrams show, that with this construction of valve there is very little or no throttling of the steam; and also that there is but a very moderate drop in the pressure, as the steam passes from the small cylinder into the large one. In this respect the valve completely answered the expectations entertained of it, and left little further to be desired on this point.

In order to compare these diagrams with theory, it is necessary to know the cubic contents of the cylinders with the given lengths of stroke, of the clearances at the ends of the cylinders, and of the different parts of the steam passages. The following are the capacities of these spaces:—

|                                                        | Cub. In. | Cub. In. |
|--------------------------------------------------------|----------|----------|
| Capacity of small cylinder, 5 ft. 6½ in. stroke ... .. | ...      | 40,870   |
| Clearance at end of small cylinder ... ..              | 308      |          |
| Space in port between valve and small cylinder ... ..  | 805      |          |
| Total space between valve and small piston ... ..      |          | 1113     |
| Capacity of large cylinder, 8 ft. stroke ... ..        | ...      | 159,542  |
| Clearance at end of large cylinder ... ..              | 831      |          |
| Space in port between valve and large cylinder ... ..  | 2844     |          |
| Total space between valve and large piston ... ..      |          | 3675     |
| Capacity of all passages in valve ... ..               | ...      | 3944     |
| Sum of last two capacities ... ..                      | ...      | 7619     |

Hence, the steam escaping from the small cylinder has to expand into an additional space of 7619 cubic inches before it reaches the large piston.

The following Table shows the principal results deduced from these indicator diagrams, in the calculation of which it has been assumed that the space occupied by the steam when expanded is inversely as the pressure; and also that the valve and pistons were steam-tight when the diagrams were taken, which is believed to have been nearly the case. For the sake of simplicity also, the steam enclosed in the valve passage has been neglected, and the passage is supposed to be empty when the steam from the small cylinder enters it. The effect of the clearances and steam passages has been taken into account in calculating the expansions.

*Table of Results deduced from the Indicator Diagrams, Nos. 1 and 2.*

|                                                                                                                             | No. 1.       | No. 2.       |
|-----------------------------------------------------------------------------------------------------------------------------|--------------|--------------|
| 1. Percentage of stroke at which steam is cut off in small cylinder ... ..                                                  | 25 per cent. | 40 per cent. |
| 2. Total expansion at end of stroke in small cylinder, in terms of bulk before expansion ... ..                             | 3·78         | 2·41         |
| 3. Amount of expansion on passing from small to large cylinder, in terms of bulk before escaping from small cylinder ... .. | 1·18         | 1·18         |
| 4. Total expansion at end of stroke in large cylinder, in terms of original bulk ... ..                                     | 15·15        | 9·66         |
| 5. Total amount of efficient expansion, in terms of original bulk ... ..                                                    | 12·80        | 8·19         |
| 6. Total pressure of steam per square inch at point of cutting off ... ..                                                   | 32 lbs.      | 41 lbs.      |

|                                                                                                                                                                                                                                                                                                                                     | No. 1.       | No. 2.       |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|--------------|
| 7. Theoretical total pressure at end of stroke of small piston ... ..                                                                                                                                                                                                                                                               | 8.4 lbs.     | 17.0 lbs.    |
| 8. Actual total pressure shown by diagram ... ..                                                                                                                                                                                                                                                                                    | 10.6 lbs.    | 18.0 lbs.    |
| 9. Excess of actual over theoretical, in percentage of actual pressure ... ..                                                                                                                                                                                                                                                       | 21 per cent. | 6 per cent.  |
| 10. Theoretical loss of pressure in passage from small to large cylinder ... ..                                                                                                                                                                                                                                                     | 1.7 lbs.     | 2.6 lbs.     |
| 11. Actual loss shown by diagram ... ..                                                                                                                                                                                                                                                                                             | 2.5 lbs.     | 4.5 lbs.     |
| 12. Theoretical total pressure at end of stroke of large piston ... ..                                                                                                                                                                                                                                                              | 2.1 lbs.     | 4.2 lbs.     |
| 13. Actual total pressure shown by diagram ... ..                                                                                                                                                                                                                                                                                   | 3.0 lbs.     | 5.5 lbs.     |
| 14. Excess of actual over theoretical in percentage of actual pressure ... ..                                                                                                                                                                                                                                                       | 30 per cent. | 23 per cent. |
| 15. Mean pressure on crank pin from both cylinders ... ..                                                                                                                                                                                                                                                                           | 15,240 lbs.  | 22,400 lbs.  |
| 16. Maximum ditto ... ..                                                                                                                                                                                                                                                                                                            | 27,838 lbs.  | 36,058 lbs.  |
| 17. Ratio of maximum to mean ... ..                                                                                                                                                                                                                                                                                                 | 1.83 to 1.00 | 1.61 to 1.00 |
| 18. Ratio of maximum to mean pressure on crank pin in a single cylinder engine, with the same total amount of efficient expansion (art. 5); the clearances and ports bearing the same proportion to working capacity of cylinder,—namely 1.40th part. This ratio is calculated from the ordinary logarithmic expansion curve ... .. | 4.00 to 1.00 | 2.75 to 1.00 |
| 19. Efficiency of steam contained in large cylinder at end of stroke, as shown by diagram, if used without expansion, taken as ... ..                                                                                                                                                                                               | 1.00         | 1.00         |
| 20. Actual efficiency of same steam as employed in both cylinders, as shown by diagram ... ..                                                                                                                                                                                                                                       | 2.70         | 2.90         |
| 21. Theoretical efficiency of same steam, if expanded to same degree as total amount of efficient expansion (art. 5) ... ..                                                                                                                                                                                                         | 3.56         | 3.10         |

These indicator diagrams show, in different degrees, a few results which the author has constantly observed in all the indicator diagrams he has taken from double-cylinder engines. In the first place, the pressure of the steam at the end of the stroke, instead of falling short of what it ought to be by the theoretical expansion curve, always exceeds that amount. In one case this excess is as much as 30 per cent., and in the other it is 23 per cent. of the actual final pressure. This fact has been often observed before to a smaller extent in single cylinder engines, and has been said to be peculiar to cylinders without jackets, or external means of keeping up their heat. But in this case both cylinders were jacketted, and the jackets were supplied with steam of a higher pressure than the maximum pressure in the cylinders. It might be supposed that the increased pressure at the end of the stroke was due to the heat imparted from the jackets, either superheating the steam or converting the watery vapour mixed with it into true steam; and probably the latter is the cause of a small part of the observed effect. But, in the author's opinion, it is not likely that sufficient heat could be communicated from the jackets to produce an increase of 23 per cent. in the actual final pressure, much less of 30 per cent. This is the more unlikely, because on several occasions the condensed water from the jackets has been collected, and found not to exceed half a gallon per hour. The experiments made on the quantities of water passed from the boilers give uniformly the result, that a considerably larger quantity of water passes from the boilers than is accounted for by the indicator diagram, taking the quantity and pressure of the steam just before it escapes to the condenser as the basis of

calculation. In some trials made, the excess of water thus disappearing from the boilers, was about 37 per cent. It appears, however, to the author that this constant excess of the actual over the theoretical final pressure of the expanded steam is still not satisfactorily explained. To suppose that the valve was leaking might account for it; but besides great care having been taken to avoid this source of error, it can hardly be supposed that the valve was always leaking more than the pistons.

Secondly, although the pressure of the steam in the cylinders in these engines always exceeds what would be given by theory, yet the loss of pressure in passing from the small cylinder to the large one always exceeds what would be expected from theory. This fact holds as universally as the previous, in the author's experience, although by no means to a uniform extent.

Thirdly, the table shows the great practical advantage that the double cylinder engine possesses in moderating the extreme strains on the machinery which are produced when expansion is carried to a great extent in a single cylinder. The maximum pressure on the crank pin from both cylinders is here only 83 per cent. greater than the mean in the diagram No. 1, and only 61 per cent. greater in the diagram No. 2. It is indeed impossible, in practice, to carry expansion in one cylinder to so high a degree as is shown in these diagrams. Although single cylinder engines are frequently said to be expanding ten times, the author has not known any instance of their being so worked continuously, but only occasionally and experimentally; and in no case that he is acquainted with, has the expansion ever been more than nominally to the extent of ten times, that is, the steam has been cut off at 1-10th of the stroke from the commencement. In such a case the size of the valve passages and clearance of the piston amount to so large a proportion of the steam in the working part of the cylinder at the moment of cutting off, that a nominal expansion of ten times is often in reality not more than six or seven times. In the small cylinder of the double cylinder-engines now described, the passages and clearances are reduced to a minimum, and are much smaller than in most single cylinders of the same size; and yet if the steam were here cut off at 1-10th of the stroke, these passages would amount to one-fourth of the volume of the steam contained in the cylinder at the moment of cutting off; and the expansion in this cylinder, instead of being ten times, would be only about eight times. This is a point too generally neglected in estimating the merits of different engines, or discussing the results of indicator diagrams.

To ascertain the amount of friction in these engines, the author has made many experiments, and has found that, when the engines are new, and working at perhaps little more than half their power, the loss in comparing the work done with the indicated diagrams amounts to as much as 25 per cent. of the indicator power; but in these cases the pistons have been too tight in the cylinders; and when this error has been corrected, and the engines worked up to their regular work, all the losses are brought down to from 12 to 15 per cent. of the indicated power. This includes the friction of both the engines and the pumps, the working of the air pumps, feed pumps, cold water pumps, and pumps for charging the air vessels with air.

On the whole, the author is of opinion that, where expansion is carried to an extent of only three or four times, the single-cylinder form of engine is simpler and better than the double cylinder; but where expansion is required to a much higher degree, the double cylinder presents the only way of carrying it out successfully in practice. When the double cylinder is adopted, an ordinary expansion of not less than ten times should be effected, if it is desired to get a result corresponding with the additional complication incurred. The theory of the action of steam jackets appears still somewhat doubtful, but there can be no doubt that, with high expansion in two cylinders, they are absolutely essential to a favourable economical result.

With regard to the economy of fuel attained by the double-cylinder engines, it may be stated that the four pumping engines at the Lambeth Water Works are fixed in one house, and are employed in pumping through a main pipe, 30 inches diameter and about nine miles in length; and when all the engines are working together at their ordinary speed of 14 revolutions per minute, the lift on the pumps, as measured by a mercurial gauge, is equal to a head of about 210 feet of water. Under these circumstances they were tested by Mr. Field soon after being finished, in a trial of twenty-four hours' duration without stopping. The actual work done by the pumps during this trial was equal to 97,064,894 lbs., raised one foot high, for every 112 lbs. of coal consumed; in addition to which, this consumption included the friction of the engines and pumps, and the power required to work the air pumps, feed and charging pumps, and the pumps raising the water for condensation. The coal used was Welsh, of good average quality.

The economy in consumption of fuel, during this trial and in the subsequent regular working of these engines, together with the satisfactory performance generally of the engines and pump work, induced the Chelsea Water Works Company, and also the New River Company, each to erect, in 1854, a set of four similar engines, which were made almost exactly the same as the Lambeth Water Works' engines already described, with the exception that a jacket of high pressure steam was, in these subsequent engines, provided under the bottoms of the cylinders, which had not been done with the previous engines. The pumps were also different in size, to suit the different lifts.

The New River engines were tested soon after being completed, and the result reported was 113,000,000 lbs., raised one foot high by 112 lbs. of Welsh coal. But this duty was obtained from a trial of only 7 or 8 hours' duration, which is too short to obtain very trustworthy results; and similar circumstances, the author believes, have given rise to the extraordinary statements that have sometimes been made regarding the duty obtained from steam-engines.

The set of engines made for the Chelsea Water Works was the last finished, and, on completion, the engines were tested by Mr. Field, in the same manner as the Lambeth engines—by a trial of twenty-four hours' continuous pumping. The coal used was Welsh, as before, and the duty reported was 103.9 million lbs., raised one foot high, by 112 lbs. of coal. This, as in the previous instance, was the duty got from the pumps in actual work done, no allowance being made for the friction of the engines and pumps, and the power required to work the air pumps, cold water pumps, &c. At the time of these engines being

tested, the loss by friction, and by working the air pumps, &c., averaged about 20 per cent. of the power, as given by the indicator diagrams; so that if the duty had been estimated from the indicator diagrams, as is usual in marine engines, it would have been  $103.9 \times \frac{1.00}{.80}$ , or about 130 million lbs., raised one foot by 112 lbs. of coal, which is equivalent to a consumption of 1.7 lbs. per indicated horse power per hour.

Mr. Pole said that, in the investigation of the double-cylinder engine, he had been desirous of entering rather fully into its history, which had previously been involved in some obscurity. Few seemed to be aware of the extent of Hornblower's connection with the engine, which was generally called Woolf's, although it was certainly Hornblower's invention; and the principle of expansion, one of the most important principles in the steam-engine, was first introduced to the world in Hornblower's engine. The revival of this same engine, at a subsequent period, was due to Woolf, who simply applied high-pressure steam to it, as was done also about the same time by Trevithick to the single-cylinder engine in Cornwall: in the latter case the circumstances were so far different from those of other engines, that the single-cylinder engine was here undoubtedly the best for the purpose to which it was applied.

The double-cylinder engine, as now practically carried out in the manner described in the paper last read, proved a very useful arrangement, by affording the means of carrying the important principle of expansion to a much greater extent than was practically possible in the single-cylinder engine. In a single-cylinder engine, when applied to pumping without a crank and fly wheel, [it was indeed possible to make use of a considerable degree of expansion, because the blow, which then inevitably came at the commencement of the stroke, was immediately absorbed by the inertia of the mass: but when the piston was controlled by a crank and fly-wheel, he thought experience proved that it was scarcely possible to expand more than four or five times without producing a very great strain on the machinery; beyond that expansion, the engine could not be made strong enough, and the blow was what no engineer would like to incur. His object, however, had been to show, in the paper, that the initial blow might be greatly reduced, and its injurious effect avoided, by first expanding the steam partially through a portion of the stroke in the small cylinder, and then completing the expansion in the large cylinder; and also to show that, by the adoption of this plan, a point of cut off could be found, at which the initial blow would be reduced to the minimum.

Mr. Thompson stated, that in the engines from which the indicator diagrams were taken, the boiler pressure was 40 lbs. per square inch above the atmosphere, and the initial pressure of the steam in the small cylinder was 35 lbs. The expansion in the first indicator diagram appeared to be 16 times, if merely the point of cut off were taken into consideration; but by including the effect of the capacity of the ports, the actual expansion was 15 times; and if the useless effect of the expansion of the steam into the valve between the cylinders were also deducted, the total efficient expansion was found to be nearly 13 times; that is, the volume occupied in the cylinders alone by the steam at the



end of the stroke was 13 times as great as at the point of cut off. The steam would therefore be in reality expanded to that extent if its expansion followed the regular logarithmic curve; but the indicator diagram showed that the final pressure at the end of the stroke was 30 per cent. in excess of the theoretical pressure corresponding to the total expansion of 15 times, and therefore the actual expansion was proportionately less.

Mr. J. Grantham enquired, whether the steam was superheated in the engine from which the indicator diagrams had been taken.

Mr. Thompson said, the steam was not superheated, except by the heat obtained from the steam jacket of the cylinders, which was filled with steam at the boiler pressure.

Mr. J. Grantham thought that would probably account both for the pressure of steam being raised at the end of the stroke above the theoretical pressure, and also for the loss of water from the boiler, which had been stated to amount to 37 per cent. in excess of the consumption of water, as calculated from the volume of steam contained in the small cylinder at the point of cut off. This extra amount of water must evidently have been carried off from the boiler, mixed with the steam by priming, and then became evaporated at the end of the stroke by the heat from the steam jacket; but if the steam had been superheated immediately on leaving the boiler, before entering the cylinder, no water would have passed over with it, and there would have been no loss of water from the boiler, while the pressure would have followed the regular curve during the expansion.

The progress of the application of expansion in the steam engine, of which so interesting an account had been given, was a remarkable history, and seemed to have been divided into three distinct eras; the original idea of expansion having virtually died out after its first promulgation, until revived in 1814 by Trevithick and Woolf, in connection with a higher pressure of steam; then it again fell into neglect, and the great majority of engines were worked with little or no expansion whatever; and it was only within the last few years that the subject had now been again revived. The principle of expansion was one of such great practical importance that it required the most attentive consideration in all classes of steam engines. He remembered seeing at Stroud, about twenty years ago, a small double-cylinder engine of about four-horse power, which had been put up about thirty years previously by Woolf himself. It was employed in a brewery, and had a large cast-iron boiler, with some cast-iron tubes through it, and the boiler was apparently as good as ever, after thirty years' work, during which it had been going on without repairs. The engine was working with high-pressure steam, about 60 lbs. per square inch above the atmosphere, and showed a remarkable economy in fuel, quite unequalled by any of the numerous other engines employed in the woollen manufacture in that neighbourhood. The latter, however, though good engines, were all worked on the common low pressure system, and in none of them was the use of high-pressure steam with expansion ever adopted for about twenty years after the erection of Woolf's small engine. A second engine, on the same plan, was, however, at length put up there, of about 30 horse-power, carrying out the principle of expansion with high-pressure steam; and this

engine had, at the time he saw it, been working for nearly ten years, consuming only about  $2\frac{1}{2}$  lbs. of coal per horse power per hour, whereas many engines in the neighbourhood were using as much as 12 lbs.: yet no one else had at that time attempted to repeat the engine, notwithstanding the extent of steam power employed in the neighbourhood. This was an illustration of the indifference with which so important a subject had been treated, and not in that district alone, but throughout the entire country; but now that it was again revived, the question could not be discussed too frequently, not only as regarded manufacturing purposes, but more especially in reference to marine engines.

From an examination of the various steam engines exhibited in the present International Exhibition, he was confirmed in the opinion that the expansive use of steam was much more fully carried out on the continent than in this country; probably arising from the greater cost of fuel there. On the continent the double-cylinder engine was in common use, and had been so for many years; and in some localities he believed it was used exclusively. It was, moreover, curious, that in most of the descriptions given of these engines, Woolf's name was associated with them; and foreigners generally seemed to look upon Woolf as the originator of the double-cylinder engine, which strictly he was not, although he revived its use, and thereby probably did a greater service than even the original inventor; because he brought into use what Hornblower had not succeeded in establishing.

Since the time of Woolf's revival of the double-cylinder engine, so great an advance had been made in the construction of stronger boilers, and the use of a higher pressure, and in the introduction of superheating, that there was now a better prospect of extending the adoption of this engine, in which expansion could certainly be carried to a much greater extent than in a single cylinder, as shown in the paper. But there was still much to be done in respect of increasing the pressure of steam in stationary and marine engines, in which at present the common practice was to use only about 25 lbs. pressure per square inch; whereas, in locomotives, the pressure was frequently as high as 150 lbs., and would probably be carried higher. If this pressure could be attained in marine and stationary engines, great economy of fuel would result; but the greater expense required in the construction of the engine in the first instance was, in most cases, the obstacle in the way of any high degree of expansion: and even where an engine was provided with separate valves for working expansively, the expansion valves had been abandoned, and the full steam kept on through the entire stroke, involving a wasteful consumption of fuel. The papers that had been read would, he thought, do much towards advancing the general knowledge of the value and practicability of the double-cylinder arrangement.

In pumping engines, indeed, such as had been described, the slow and deliberate action, and the careful way in which such engines were generally attended to, afforded peculiar advantages for carrying out the application of the double-cylinder engine; but there were other cases, especially marine engines, in which economy of fuel was evidently of far greater importance than in pumping engines; because the weight of fuel formed a limit to the load that could be carried: and to

marine engines, therefore, the application of a high degree of expansion was particularly desirable. It was not necessary, however, to adhere closely to the arrangement of the double cylinders that was adopted for the pumping engines, which, in many cases, would be inconvenient; since it would necessitate either four cranks for two pairs of cylinders, or else the use of a beam for each pair, as in the pumping engines. In the marine engines shown in the Exhibition by Mr. Humphrys, similar to those working in the "Mooltan" with Hall's surface condensers, the small cylinder was mounted on the top of the large one, and the same piston-rod was carried through both cylinders; requiring some alteration in the arrangement of the passages to convey the steam from the small cylinder to the large one. But the short distance that the steam had here to travel from the bottom of the small cylinder to the top of the large one compensated for the long distance it had to travel from the top of the small to the bottom of the large cylinder; so that he believed there was altogether not much difference in loss of pressure in the steam passages between these engines and the double-cylinder pumping engines shown in the present paper. There was also a small horizontal engine among the Belgian machinery in the Exhibition, designed for driving the gun-boats of the Swedish navy, which had a small cylinder placed within a large one, with three piston rods,—one from the inner piston, and the two others from the outer annular piston. The high-pressure steam was admitted to the inner cylinder, whence it was conveyed to the outer low-pressure cylinder by passages through the cylinder covers, with a considerable loss of pressure in the passages in this case on account of their length. In other respects, the arrangement seemed good; and it was simple, and well adapted for the purpose for which it was intended.

Mr. John Scott Russell said, the introduction of a high degree of expansion in marine engines was greatly to be desired, but the difficulty attending it was the great strain thrown upon the machinery at the commencement of the stroke, compared with the mean force of the entire stroke; and it was with the view of obviating this difficulty that he had himself designed, some years ago, the plan which had been mentioned of putting the small cylinder inside the large one, and working with three piston rods, admitting the high-pressure steam to the inner cylinder and expanding into the outer. There were, however, several inconveniences, for the practical purposes of steam navigation, in any of the combinations of cylinders that he had yet seen. Working with two cylinders was attended with certain trammels in the case of marine engines, which virtually limited the expansion to a particular grade; whereas, the special want in steam navigation was the means of working with a great variety of grades of expansion, and sometimes with no expansion at all, but with the full power of both cylinders. When this difficulty was surmounted, the great practical inconvenience of double-cylinder engines, for marine purposes, would be got rid of. Another difficulty in the way of extending the degree of expansion was the want of a better class of men to attend to the engines placed in vessels; until superior men were employed, it would be unwise to attempt obtaining the large economy that would result from greater expansion, higher pressure, superheating, and surface condensation,

with the use of more costly engines and stronger boilers. In order to get over the difficulty of repairs, arising from the complexity of a double-cylinder engine, he had arranged an engine with three separate cylinders, all working expansively, and acting direct upon one crank, so as to have the free use of any degree of expansion, without the disadvantage of the double-cylinder arrangement. With this engine, expanding the steam about four times in each of the three cylinders, the consumption of coal, in ordinary working, was brought down to about  $2\frac{1}{2}$  lbs., and even 2 lbs. per horse-power per hour. Marine engines, however, had not the same advantages for great expansion as pumping engines, in which the large mass to be put in motion absorbed the excess of power at the beginning of the stroke, and served as a reservoir of power to perform the remainder of the work, when the high pressure of the steam was reduced by expansion.

Mr. E. E. Allen observed, that the alleged difficulty of obtaining a temporary increase of power had been frequently urged against the use of double-cylinder expansive engines for marine purposes; but he was not able to see how the objection applied, because the steam, instead of being cut off at a third or a half of the stroke, or at any other point that was desired, might be kept on for the full length of stroke in the first cylinder, when the full power of the engine was wanted. In ordinary marine engines, cutting off at three-quarters of the stroke, there was no means of adding to the power more than about one-fifth; but if a larger and more expansive engine were used, with the steam cut off at one-third of the stroke in the small cylinder, which was what was generally proposed in double-cylinder expansive marine engines, the power could be increased between two and three times. An important difference, moreover, between the application of the double-cylinder expansive arrangement to marine engines and to other purposes was, that while it was quite possible in pumping engines, and in most other cases, to lengthen the cylinders for an increased expansion—making the length of stroke frequently three or four times the diameter—it was impossible to do so in marine engines, which were confined within very narrow limits, so that the cylinders assumed a different shape from those in other engines; in marine engines of 1200 horse power now being made, the diameter of the cylinder was more than double the length of stroke—the diameter being nearly 10 feet while the stroke was only 4 feet. In cylinders of these large diameters, however, not only was the initial blow of the steam very much in excess of anything that was met with in pumping engines, but there was a heavy loss in the clearance space at the end of the cylinder, bearing a large proportion to the whole steam used if the steam were cut off at an early part of the stroke. The double-cylinder engine had, therefore, a great advantage for short strokes, by reducing the initial blow with a high degree of expansion; and he believed it afforded the only practical mode of carrying out expansion to any high degree in marine engines. He had proposed placing the cylinders horizontal, with the small cylinder at the back of the large one, instead of the vertical arrangement adopted in the "Mooltan" and other vessels, because he objected to raising the engines, especially when the cylinders were large and heavy.

The degree of expansion and point of cut off to be adopted depended

upon the pressure of steam employed: with an initial pressure of 20 lbs. per square inch above the atmosphere, he had proposed that the steam should be expanded 7 times, and about 10 times for 60 lbs. total pressure, and, perhaps, 18 times for 120 lbs.: the economy obtained being greater the higher the pressure of steam used. The expansion of 7 times was the same that had been adopted by Mr. Humphrys and Messrs. Randolph and Elder with 20 lbs. steam or 35 lbs. total pressure; the object being to expand the steam down to a final pressure of about  $4\frac{1}{2}$  or 5 lbs. per square inch above a vacuum.

When expansion was fully carried out in marine engines, there was reason to look forward to the consumption of fuel being reduced to less than half what it now was. At present, the average consumption reached  $4\frac{1}{2}$  or 5 lbs. per indicated horse power per hour, but by expanding 7 times with 20 lbs. steam, he believed this would be brought down to  $2\frac{1}{2}$  lbs. per horse power per hour; and if surface condensation were employed in addition, the consumption would be further reduced to  $2\frac{1}{2}$  lbs. of fuel, which was the actual consumption in the engines of the "Mooltan" during a continuous sea voyage, and also in Messrs. Randolph and Elder's engines.

Mr. E. A. Cowper did not consider it was necessary to adopt the plan that had been mentioned of having three cylinders in marine engines for obtaining a high degree of expansion; nor did he think the other plan of putting the small cylinder inside the large one was altogether advisable, as it involved certain complications of construction. In the latter case, although there were two cylinders, they could act only on one crank; and the outer annular piston would be subject to a great amount of wear, by being confined between the two cylinders, instead of being left as free as possible in working, which was particularly desirable in a marine engine. The use of two cylinders of different size, with cranks at right angles, had been tried several times, by Mr. Zander, about fourteen years ago, by Mr. Rontgen, about eleven years ago on the Rhine, and by himself, twelve years ago; the steam expanding out of the small cylinder into the large one. This plan required a space between the two cylinders for the steam to expand into on leaving the small cylinder, because at the end of the stroke of the small cylinder the crank of the large cylinder was at half stroke, and therefore not in the position for taking steam; so that a steam-jacketed reservoir was required, into which the steam could be exhausted from the small cylinder, and in which it could be kept without any loss of heat, and be slightly superheated before being admitted into the larger cylinder. In this particular arrangement, he had found that a great advantage in uniformity of power was obtained by cutting off the steam at particular points near half stroke in both cylinders. It had been proposed, many years ago, to cut off the steam at half stroke, with the view of obtaining uniformity of rotative power; but the exact point of cut off had to be ascertained for each case, to produce the best result. The total variation from the average rotative power, when the steam was admitted through the whole stroke in both cylinders, was 31 per cent.; but when cutting off at the most advantageous point near half-stroke in each cylinder, it was only 14 per cent.

In the case of using full steam throughout the whole stroke, it had also to be observed, that the variations in rotative power were not only

large in amount but long continued; for instance, in the first quarter of the revolution, the power was greatly in excess of the average, but, in the third quarter, it was greatly below the average. When cutting off, however, at the most advantageous point, each quarter of the revolution had nearly the same rotative power. The results stated had been obtained with a 40 horse power horizontal engine, constructed by Messrs. Walter May & Co., shown at the International Exhibition.

## THE LONDON ASSOCIATION OF FOREMEN ENGINEERS.

August 1, 1863.

Mr. WILLIAM MUIR, OF WOOLWICH ARSENAL, VICE-PRESIDENT, IN THE CHAIR.

Mr. HUMES read a paper "*On the construction of locks.*"

THE author acknowledged that his subject had been frequently dealt with at other institutions. Tracing the history of lock making from the earliest period, however, he made lengthy reference to the lock controversy of 1854-5, and then described the peculiarities, mechanical and otherwise, of the best constructed locks of the present time. It is not necessary for us to follow the speaker through his exhaustive and well-written treatise, because the ground has been trodden over before, and has thus lost some of its interest.

A vote of thanks was justly accorded to Mr. Humes at the conclusion of the paper.

## Provisional Protections Granted.

[Cases in which a Full Specification has been deposited.]

1863.

1846. Moritz Meisel, of Brompton, impd. apparatus for regulating the speed of trains on railways, and in assisting the locomotive engine and train in ascending and descending

inclined planes,—a communication. —July 23rd.

1900. Robert Stewart, of Elmira, U.S.A., impts. in operating the cut-off valves of steam engines.—July 31st.

[Cases in which a Provisional Specification has been deposited.]

737. Henry Osburne Haughton, of Liverpool, impts. in machinery for drying and cooling grain and seeds,—a communication.—March 19th.

807. John King, of Chadshunt Farm, near Kineton, and Thomas Henry Marshall, of Combroke, Warwickshire, impts. in machinery and apparatus for preparing land for seed and for harrowing land.—March 27th.

992. Hudson Yeadon, Edwin Yeadon, and Samuel Yeadon, of Stockport, and John Yeadon, of Leeds, impd. healds for weaving.—April 21st.

999. Thomas Settle, of Bolton, impts.

in "flyers," to be employed in roving, slubbing, and spinning cotton and other fibrous substances.—April 22nd.

1151. Henry Schooling, of North-side, Bethnal-green, impts. in moulding or shaping lozenge paste, or other plastic materials.

1154. Joseph Henry Bailey, of New York, impd. mechanical movement for producing an impelled current of air for lamps, and which may be used for other purposes,—a communication.

The above bear date May 8th.

1293. Edward Barlow, of Bolton, John Ashworth, jun., of Turton, near Bolton, James Newhouse, of Farnworth, near Bolton, and Francis Hamilton and William Hope, of Bolton, impts. in lap machines for preparing cotton and other fibrous substances.—*May 23rd.*
1328. Antoine Pascal Hernandez and Pierre Bélisaire Crespy, of Bordeaux, impts. in the manufacture of soap.—*May 27th.*
1375. George Hallen Cottam, of St. Pancras Iron Works, impts. in bricks suitable for being used for paving stables and other places.—*June 2nd.*
1385. Edward Augustus Locke, of Boston, U.S.A., impd. means of securing identifying labels or tags to bales of fibrous material,—partly a communication.—*June 3rd.*
1455. Charles Louis Van Tenac, of Tredegar, impd. daily balance book, with moveable or sliding tickets or slips,—a communication.—*June 11th.*
1486. Marcus Brown Westhead, of Manchester, impts. in adapting tapes, ribbons, and other such narrow fabrics or thread to surfaces from which they may be unwound, or upon which they may be re-wound.
1487. Isaac Gray Bass and William Bass, of Broughton Little, Cumberland, impts. in the manufacture of nails and spikes.
1488. Henry Graham William Wagstaff, of Radnor-terrace, impd. apparatus for feeding steam boilers with water; which apparatus is also applicable for raising water.
1489. Samuel Sinclair Robson, of Sunderland, impts. in apparatus for working the rudders of vessels, and in auxiliary steering apparatus.
1490. James Shand, of Upper Ground-street, Blackfriars, impts. in the arrangement and construction of steam fire engines, and in steam boilers for the same; such boilers being applicable to other purposes.
- The above bear date June 13th.*
1492. John Forrester, of Burslem, impts. in the manufacture of bricks, quarries, slabs, tiles, earthenware pipes, and other earthenware or ceramic articles.
1493. Thomas Cope, of Liverpool, impts. in the construction of rocking horses, and in giving additional motion thereto,—a communication.
1494. Henry Bernoulli Barlow, of Manchester, impts. in machinery for opening and cleaning cotton and other fibrous substances,—a communication.
1495. Isaac Blue Harris, of the North British Rubber Company, Edinburgh, impts. in the manufacture of flexible and other tubes.
1496. John Juckes, junior, of Old Ford, Bow, impts. in furnaces.
1497. Tony Petitjean, of Geneva, impts. in the manufacture of glass.
1498. Robert Wilson Gordon, of Belfast, impts. in machinery for spinning flax and other fibrous substances.
1499. William Clark, of Chancery-lane, impts. in engines for obtaining motive power from steam or other liquid; also partly applicable to pumps,—a communication.
1500. Patrick Plunkett Leslie Stafford, of St. James's-square, impts. in fire-arms.
- The above bear date June 15th.*
1501. James John Shedlock, of Vincent-street, Westminster, impts. in valves for the passage of steam, gas, and fluids.
1502. Francis Stanton Williams, of Boston, U.S.A., impd. apparatus for shaping plastic materials, and hot, but not melted metals, by means of pressure, percussion, or rolling,—a communication.
1503. William Manwaring, of Banbury, impts. in harvesting machines.
1505. John Lightfoot, of Accrington, impts. in fixing mordants in the processes of dyeing and printing textile fabrics or yarns.
1506. Josiah George Jennings, of Palace-road, Lambeth, and Manuel Leopold Jonas Lavater, of Bath-street, impts. in moulding and vulcanizing articles of india-rubber.
1507. William Score, of St. Paul's-road, Camden Town, impts. in the manufacture of candles and soap.
1508. Joseph Steele and William Mason, of Leeds, impts. in apparatus for removing the bran or outer skin from wheat and other grain.
1509. Alexander John Fraser, of Water-

- lane, impts. in apparatus applied to house and carriage window sashes, for the working and fastening thereof.
1510. William Neill, junior, of Bold, near St. Helen's, impts. in steam engines.
1511. John Collingwood Onions, of Birmingham, impts. in smiths' and other bellows.
1512. Richard Archibald Brooman, of Fleet-street, impts. in protecting or preserving the silvering or quicking on glass, and in the manufacture of glass vessels for silvering or quicking,—a communication.
- The above bear date June 16th.*
1513. William Henry Dawes, of West Bromwich, impts. in the manufacture of iron.
1514. John Banwell of Watlington, Oxfordshire, a combined machine for collecting and placing in rows, or collecting and elevating into a wagon or elsewhere, hay, corn, or other agricultural produce.
1515. John Mills, the elder, of Sunderland, impts. in the square rigging of vessels.
1516. James Newnam, of Crayford, impd. means of, and apparatus for, boiling *in vacuo* at a low temperature.
1517. John Frederick Spencer, of New-castle-on-Tyne, impts. in steam, gas, and water tube joints.
1518. William Crofts, of New Lenton, near Nottingham, impts. in the production of fabrics by lace machinery, and in means or apparatus employed therein.
1519. Fédor de Wyldé, of Great College-street, Camden Town, impd. means for the protection and preservation of lead surfaces exposed to the action of water, and for the protection of such surfaces from decomposition by atmospheric action,—a communication.
1520. Edward Wolf, of Sambrook-court, impd. wrapper or wrapping material for use in smoking tobacco.
1521. Thomas Purdie, of Oxford-street, impts. in the plastering, coloring, and decoration of walls and ceilings.
1522. Alexander Samuelson, of Cornhill, impts. in apparatus for evaporating liquids.

1523. William Naylor, of Queen's-road, Dalston, impts. in apparatus for compressing, holding, and regulating the pressure of gas.

*The above bear date June 17th.*

1524. John Alexander Sparling, of Upper Hornsey-rise, impts. in twisting and winding silk, and in the machinery or apparatus to be employed therein.
1525. Jules Louis Ganne, of Cour-Cheverny, France, impts. in toy pistols.
1526. William Scowcroft Lowe, of Disley, Cheshire, and John Cheetham, of Oldham, impts. in self-acting mules for spinning cotton and other fibrous materials.
1527. David Barker, of Milton-street, Wandsworth-road, impts. in the treatment and preservation of yeast.
1529. Ephraim Ivett, of Bedford, impd. machinery for manufacturing tiles.
1530. Robert Jobson, of Dudley, impts. in machinery for making moulds to be employed when casting metal.
1531. Edward Gossiaux, of Lacken, near Brussels, impd. machine for making bolts, rivets, and spikes.

*The above bear date June 18th.*

1532. Henry Reynolds, of Fleet-street, impd. method of rendering atmospheric air fit for illuminating purposes, and of increasing the illuminating power of inflammable gas.
1533. Edmund Howarth and John Brown, of Tonge, near Middleton, impts. in apparatus for steaming cotton or other fibrous substances.
1534. Samuel Middleton, of Hants, Berkshire, impts. in the manufacture of iron or other metal shoes, and in the method of securing the same to the hoofs of horses and other animals, without nails.
1535. Robert Marrison, of Norwich, impts. in breech-loading fire-arms.
1537. Augustin Morel, of Roubaix, France, impts. in machinery for combing wool and other fibrous material.
1538. Augustin Morel, of Roubaix, France, impts. in traction engines.
1539. Joseph Watts, of Coventry, impts. in machinery or apparatus for the manufacture of malt.



1540. William Hicklin, of Ball's-pond, impts. in metal screens and sieves for screening and sifting; applicable also to other openwork articles.
1541. William Edward Newton, of Chancery-lane, impts. in the manufacture of leaden pipes,—a communication.
1542. Michael Henry, of Fleet-street, impts. in decorticating grain and seeds, and in the application of the products obtained by, and materials used in, decorticating,—a communication.

*The above bear date June 19th.*

1543. Thomas Smith, of Leeds, Thomas Moore, of Wandsworth, and Major Burrell, of Leeds, impts. in the construction of reels covered with silk or other suitable material, used as machines for the purpose of dressing flour.
1545. David Dunne Kyle, of Victoria-street, Westminster, impt. in baths.
1546. George Haseltine, of Southampton-buildings, imptd. oil, more especially designed for mixing paints and colors, and new mode of manufacturing the same,—a communication.
1547. Robert Brownlee, of Glasgow, impts. in sawing machinery.
1548. Philip Fassio, of Nismes, France, method of connecting several fire-places with one chimney.
1550. Charles Peterson, of Newport, Isle of Wight, a new material or compound applicable to the manufacture of pipes or tubes, for caulking or covering ships' bottoms, and to other useful purposes.
1551. James Langton Clarke, of Westbourne-terrace, Hyde-park, impts. in apparatus for turning over the leaves of music and other books.
1552. Henry Macaulay, of Rotherham, impts. in covers or appliances for the rims, borders, or top edges of chamber utensils; applicable also to commodes and water-closets.
1553. Fleeming Jenkin, of Duke-street, Adelphi, electric tell-tale compass.
1554. Alexander Theodor Nicholaus Goll, of Caledonian-road, impts. in the manufacture of mountings or settings for precious or other stones.

1555. William Louis Winans, of Dover-street, and Thomas Winans, of Baltimore, U.S.A., impts. in the construction of steam vessels.
1556. William Louis Winans, of Dover-street, and Thomas Winans, of Baltimore, impts. in couplings for propelling shafts of ships or vessels.
1557. William Louis Winans, of Dover-street, and Thomas Winans, of Baltimore, U.S.A., impts. in adapting propellers for propelling ships or vessels for ocean navigation.
1558. William Louis Winans, of Dover-street, and Thomas Winans, of Baltimore, impts. in adapting propellers for propelling ships or vessels for ocean navigation.
1559. William Clark, of Chancery-lane, impts. in the treatment of broom, for the manufacture of paper pulp,—a communication.
1560. James Booth the younger, of Halifax, Yorkshire, impts. in winding machines.

*The above bear date June 20th.*

1561. John Sainty, of Burnham Market, Norfolk, imptd. turnip cutter for cutting the last slice.
1562. Edwin Wilks, of Cheltenham, impts. in making portmanteaus and trunks of various shapes and sizes, light, strong, airtight, and watertight, capable of bearing immersion in water without injuring the contents.
1563. Alexander Twaddell, of Glasgow, impts. in sizing or preparing warps.
1564. John McLean, of West Calder, impts. in treating oil from shale or other bituminous minerals, and similar oils, to obtain various products therefrom, and in apparatus therefor.
1565. William Snell, of Clement's-inn, impts. in arrow-shaped projectiles, and in guns for discharging the same,—a communication.
1566. Francis Boulton, of Liverpool, imptd. method or process for obtaining patterns and designs for the arts and manufactures,—a communication.
1567. Louis Antoine Majolier, of Stoke Newington, impts. in apparatus for carburetting gases,—a communication.

1568. William Rowan, of Belfast, impts. in pistons.
1569. William Clark, of Chancery-lane, impts. in apparatus for charging air or gases with combustible vapours,—a communication.
1570. William Louis Winans, of Dover-street, and Thomas Winans, of Baltimore, impts. in adapting propellers for propelling ships or vessels.
1571. William Louis Winans, of Dover-street, and Thomas Winans, of Baltimore, U.S.A., impts. in adapting propellers for propelling ocean steam vessels.
1572. William Louis Winans, of Dover-street, and Thomas Winans, of Baltimore, impts. in the construction or arrangement of the working parts of engines, for actuating the propelling shafts of steam vessels.
1573. William Edward Newton, of Chancery-lane, impts. in printing machinery,—a communication.
1574. Charles Thomas Burgess, of Gower-street, impts. in reaping machines.
- The above bear date June 22nd.*
1575. John Murray, of Glasgow, impts. in machinery for making chains or chain cables and rings.
1577. James Ellison and Abraham Rogerson, of Bury, Lancashire, impts. in slubbing intermediate and roving frames, in throistles and winding machines used for the manufacture of cotton or other fibrous materials.
1578. William Wilcocks Sleigh, of London, obtaining motive power.
1579. Samuel Robinson, Joseph Priestley, and Jeremiah Foulds, of Bradford, impts. in looms for weaving.
1580. Thomas Fulham Parsons, of Maidce, Monmouthshire, impts. in the mode or modes of preparing plates, bars, or other objects of iron for being coated with metals or alloys.
1581. Richard Archibald Brooman, of Fleet-street, impts. in breech-loading arms,—a communication.
1582. William Louis Winans, of Dover-street, and Thomas Winans, of Baltimore, impts. in steam boilers.
1583. William Louis Winans, of Dover-street, and Thomas Winans, of Baltimore, U.S.A., impts. in lessening the friction of the rubbing surfaces of the slide valves of engines, and of the journals of shafts.
1584. William Louis Winans, of Dover-street, and Thomas Winans, of Baltimore, impts. in the arrangement of apparatus for superheating steam in steam boilers.
1585. Edgar Brooks, of Birmingham, impts. in breech-loading fire-arms.
1586. Andrew Mein, of Stratford, impts. in apparatus for generating steam.
1587. Franz Feichtinger, of Cumberland-street, Belgravia, impts. in the manufacture of paper, applicable for hemorrhoidal complaints.
1588. William Toovey, of Brussels, impts. in photo-lithography, photo-zincography, and photographic engraving on copper or steel plates, or on any other suitable substances.
- The above bear date June 23rd.*
1589. Samuel Knowles and Robert Hayward, of Tottington Mill, near Bury, impts. in machinery for plaiting and measuring woven fabrics.
1590. Theophilus Redwood, of Lower Homerton, impd. apparatus for straining or for mixing and straining liquid and solid substances.
1591. Paul Rapsey Hodge, of Cannon-street, impd. fleeting hydrostatic machinery, adapted to presses, dry docks, slips, or the moving or lifting of heavy masses; parts of which are applicable to the expressing of oil or other fluids.
1592. Edward Myers, of Millbank-row, and William Richard Williams, of Lamb's Conduit-street, impts. in wet gas meters.
1593. Samuel Smith, of Fell-street, impts. in the manufacture of liquorice, and in the means or apparatus employed therein.
1594. James Leigh Hughes, of Hanley, Staffordshire, impts. in ornamenting porcelain.
1595. Thomas Skinner, of Sheffield, impts. in the ornamentation of silver, German silver, Britannia metal, electro-plated or other plated goods.
1596. Andrew Edmund Brae, of Leeds, impts. in apparatus for actuating do-

meistic bells and other signals by the electric current.

*The above bear date June 24th.*

1597. Abraham Ripley, of Brook-street, Lambeth, impts. in the method and construction of a packing, chiefly applicable to piston-rods, pumps, and such like, and for forming the joints of gas, steam, or water pipes.
1598. Callistus Augustus Count de Goddes de Liancourt, of Dalston, impts. in apparatus for the preservation of life from drowning.
1600. Thomas Page, of Adelphi-terrace, impts. in horse shoes and in their fastenings.
1601. Jules Ouarnier Mathieu, of Paris, impts. in twisting machines, particularly applicable to the manufacture of strings, strands, ropes, or cables.
1602. Robert Mushet, of Coleford, impts. in the manufacture of iron and steel.
1603. William Kirrage, of Victoria-street, City, using Apo Elastikon Hyphasma as a new and improved cloth for floors, roofs, walls, tanks, and other linings, being impervious to damp and of great strength and durability.
1604. Henry Griffith Craig, of Passage West, Cork, impts. in machinery for manufacturing or preparing iron and other metal plates for ship building and other purposes.
1606. Alfred Watson, of King-street, London, impd. fastening.
1607. John Head and Henry Brinsmead, of Ipswich, impts. in machinery, applicable to thrashing machines, and for cutting and bruising straw.

*The above bear date June 25th.*

1608. Alfred Tulpin, of Manchester, impts. in machinery for stretching and drying fabrics,—a communication.
1609. William Clark, of Chancery-lane, impts. in apparatus for aerating liquids,—a communication.
1610. Gottlieb Boccius, of Henrietta-street, impd. composition, suitable for the manufacture of candles and other like articles, and of pomatum,

and an improved wick for bu with such composition.

1611. William Edward Gedge, of lington-street, impd. apparatus placing tyres on wheels, or ho or ferruling generally while the is hot,—a communication.
1612. John Griffiths, of Derby, i in machinery for puddling iro steel.
1613. Robert Mushet, of Col impts. in the manufacture of and steel.

*The above bear date June 26th*

1616. William Bradshaw and . Bradshaw, of Blackburn, Lancs impts. in looms for weaving.
1617. Edward Thomas Hughe Chancery-lane, impts. in cou for hose pipes, and also in coi ing axles to the naves or bos wheels,—a communication.
1618. John Chatterton, of Higl impts. in lining iron and other and hollow vessels, and in ma turing corrugated tubes of | materials.

*The above bear date June 27th*

1619. George Davies, of Serle- impd. cork-cutting machine,—e munication.
1620. William Andrews, of Gr House, Old Broad-street, imj apparatus for insulating e telegraph wires.
1621. Cyrus Avery, of Philad impts. in rotary engines.
1622. Lucien Ezra Hicks, of York, impt. in inkstands.

*The above bear date June 29.*

1623. Frederick Jones Duggi Bristol, impd. methods of co ing lamp chimneys and other | or shades with the burners of
1624. Louis François Auguste Marulaz, of Guéret Creuse, I impts. in the manufacture of |
1626. Joseph Simpson, of Dar impts. in iron hurdles and fen
1627. John Henry Johnson, o coln's-inn-fields, impts. in mac or apparatus for moulding or ing pottery ware,—a communi
1628. Alexander Keene Richa Berner's-street, impts. in on

and fire-arms, and in projectiles to be used therewith.

1629. Charles Henry Gardner, of West Harding-street, impts. in lithographic and zincographic presses.

1630. Alfred Silvester, of Clapham-road, impts. in apparatus to be used in the exhibition of dramatic and other like performances.

1631. Samuel Cole, of Moseley, Worcestershire, impts. in clasps or fastenings for securing brooches, solitaires, and other dress ornaments.

*The above bear date June 30th.*

1633. John Blake, of Accrington, impts. in apparatus for reducing and regulating the pressure or quantity of steam, and in discharging the water of condensed steam from cylinders, pipes, and other vessels.

1634. Thomas Alliston, of Euston-road, and Richard Swift, of Hardy-terrace, Hounslow, impd. mode of, and apparatus for, manufacturing metallic joints for bedsteads, and the application of such joints to certain parts of bedsteads.

1635. William Snell, of Clement's-inn, impd. waterproof material,—a communication.

1636. Thomas Boyle, of Gray's-inn-road, impd. system of ventilation, applicable to every description of dwelling-place and building.

1637. Cowper Phipps Coles, of Southsea, impd. method of, and apparatus for, working guns in vessels and forts, and discharging them under water.

1638. Robert Calvert Clapham, of Walker, Northumberland, impts. in the manufacture of hyposulphite of soda, sulphite of soda, and sulphite of lime.

1639. John Henry Johnson, of Lincoln's-inn-fields, impts. in coating or covering metal sheets with metals or alloys, and in the apparatus employed therein,—a communication.

1640. John Harvey and James Samuel Harvey, of Newcastle-on-Tyne, impts. in machinery for cutting tobacco into cakes suitable for the press.

1641. Thomas Taylor, of Wandsworth, impts. in railway brakes.

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1642. Hiram Hutchinson, of Paris, impts. in boots and shoes.

1644. James Cole and James Cole, jun., of Coventry, impts. in looms for weaving.

*The above bear date July 1st.*

1645. James John Shedloek, of Vincent-street, Westminster, impts. in wet gas meters.

1646. Richard Archibald Brooman, of Fleet-street, compositions for protecting metals and metallic articles from oxidation, and for coating slate, bricks, pottery, and ceramic ware,—a communication.

1647. Alexander Angus Croll, of Coleman-street, impts. in the preparation of materials to be used in the purification of gas for illumination.

1648. Edward Lloyd, of Wells-street, Marylebone, impd. composition for waterproofing, softening, and preserving all kinds of leather and articles made therefrom.

1649. William Miller, of Upper Stamford-street, impd. mode of evaporating through the combined agencies of heat and centrifugal force, and the machinery employed therein; more particularly applicable to saccharine solutions.

1650. Frederick Ransome, of Ipswich, impts. in coating or preserving iron ships or vessels, or iron used for other purposes.

1651. John King, of Chadshunt Farm, near Kineton, Warwickshire, impts. in fencing land and in hanging gates.

*The above bear date July 2nd.*

1652. Charles Martin, of Brentford, impts. in the treatment and preparation of materials for the manufacture of paper.

1654. William Edward Newton, of Chancery-lane, impts. in the treatment and preservation of skins of all kinds,—a communication.

1655. Robert Davison, of London-street, City, impts. in machinery for decorticating and cleaning corn and other grain,—a communication.

1656. Charles Baulch, of Bristol, impts. in the manufacture of boots and shoes.

1657. Henry Brinsmead, of Ipswich, impts. in cooking apparatus.

2 B

1653. Henry Thomas, of Birmingham, impts. in candlesticks.  
 1659. Hamilton Shirley Warner, of Trinidad, impd. mode of, and apparatus for, treating or preparing megass and other substances to be used as fuel.  
 1660. Evangelii Lelios, of Threadneedle-street, impts. in the means of, and apparatus for, churning.

*The above bear date July 3rd.*

1661. John Cameron Mac Donald, of Waddon, near Croydon, and Joseph Calverley, of George-street, Peckham, impts. in the manufacture and application of printing apparatus.  
 1662. Michel Emile Eyth, of Paris, impd. rotative engine.  
 1663. John McDonald, of Ashton-under-Lyne, impts. in Jacquard looms.  
 1664. Robert Flude and John Farndon, of Leicester, impts. in looms for weaving narrow fabrics.  
 1665. Josiah Gimson, of Leicester, impts. in shuttles for weaving narrow fabrics, and in mounting and fitting them to the battens.  
 1666. Henri Adrien Bonneville, of Paris, impts. in steam engines,—a communication.  
 1669. Alfred Norman, of Clarendon-road, Notting-hill, impd. apparatus for fanning or for agitating air.  
 1670. James Oxley, of Frome, impts. in filtering apparatus.  
 1671. George Allam Barrett, William Exall, Charles James Andrewes, and Alfred Barrett, of Reading, and John Leakey Bowhay, of Modbury, Devonshire, impts. in the arrangement and construction of fixed and portable combined thrashing machines.

*The above bear date July 4th.*

1672. Andrew Gower and Benjamin Smyth Gower, of Market Drayton, impd. sowing and harrowing machine.  
 1673. James Samuel, of Great George-street, impts. in the manufacture of gas for lighting and heating purposes, and in apparatus connected therewith.  
 1674. William Bridges Adams, of Hollymount, Hampstead, impts. in wheels and their tires, axles, and axle boxes,

1675. Thomas William Coul, Old Kent-road, impd. m attaching boxes or recept hold soap, black lead, or household articles to the washtubs, pails, or house bo  
 1676. John McGrigor Croft, of road, Saint John's Wood, i propellers for propelling ves  
 1677. Samuel John Cooke, c hill, impts. in apparatus for ing carbonic acid gas to c other vessels containing beer fermented liquid,—a commu  
 1678. Henry Caunter, of Sto Rosshire, impd. lubricating or composition.  
 1679. Benjamin Bonfield, of Hill, impts. in stoppers for l  
 1680. George Clayton Collyer George's-street East, impts treatment of cut tobacco better preservation.

*The above bear date July 6*

1681. Christian Schiele, of Man impts. in turbines.  
 1682. Louis Joseph Guicha Germain François Joseph L of Paris, impts. in lamps, an wicks used in such lamps.  
 1683. William Squire Bruce, c St. Helens, impts. in lucifer r fusees, and other similar lig in the boxes or holders for ing the same,—a communica  
 1684. Eliezer Edwards, of Birn impts. in instruments or appo be used in the manufacture finger plates, and other articl of glass, and in kilns for ar articles made of glass.  
 1685. George Bartholomew, lithgow, impts. in shoes for of horses and other animals, the means of connecting the  
 1686. John Orr, of Kidder impts. in weaving piled an fabrics, and in the machinery paratus connected therewith.  
 1687. William Edward Gedge, lington-street, impts. in the ction of seats, chairs, sofas, l and other similar articles of fu —a communication.  
 1688. William Edward Gedge, lington-street, impd. appara milking,—a communication.

1689. Samuel Robinson, of Dublin, impts. in spring hinges for swing doors.

*The above bear date July 7th.*

1691. Edward Myers, of Millbank-row, and Hugh Forbes, of Aberdeen-place, Maida-hill, impd. method of propelling and steering ships.  
1692. George Haseltine, of Southampton-buildings, impts. in brick machines,—a communication.  
1693. William Basford, of Pewsey, Wilts, impts. in apparatus for generating and purifying gas made from coal or other bituminous substances.  
1694. Frederick Ely, of Totton, Southampton, impd. composition applicable to corn plasters.  
1695. Henry Armstrong, of Whitby, impt. in the manufacture of alum.  
1696. John Gibson, Samuel Trulock, Richard Trulock, and William Trulock, of Dublin, impts. in breech-loading firearms.  
1697. Peter Armand LeComte de Fontaine Moreau, of Paris, mode of roofing houses, buildings, and other structures,—a communication.  
1699. Anthony Gapper Southby, of Bulford, Wilts, impts. in diverse lamps.  
1700. Rebecca Tallerman and Lewis Abraham Tallerman, of Bishopsgate-street Without, method of water-proofing and ventilating boots, shoes, and slippers, for preventing wet and damp feet.  
1702. William Edward Newton, of Chancery-lane, impts. in the construction of locks and fastenings,—a communication.  
1703. Henry Duncan Preston Cunningham, of Bury, Hants, impts. in working guns, and in matters relating thereto.  
1704. John Thomas, of Battersea, impts. in treating ores and earths containing iron in order to obtain the metal therefrom.

*The above bear date July 8th.*

1705. Samuel Davis, of the Strand, impd. "anatomical" bit for horses or other animals,—a communication.  
1706. James Smith, of Seaforth, near Liverpool, and Sydney Arthur Cheese, of Egremont, Cheshire, new descrip-

tion of hydraulic engine for raising water and other fluids above their common level; the fluids so raised to be used as a motive power.

1707. Wellington Williams, of Gutter-lane, Cheapside, impts. in shirt collars and boys' and ladies' collars.  
1708. Richard Phillipson and William Bond, of Accrington, impts. in temples for looms.  
1709. Richard Archibald Brooman, of Fleet-street, impts. in ships, and in propelling the same,—a communication.  
1710. Percy Graham Buchanan Westmacott, of Newcastle-upon-Tyne, impts. in cranes and dock-gate and other crabs.  
1711. Joseph Francis Delany and John Charles Raymond Okes, of Greenwich, impts. in the pistons of steam engines.  
1712. Percy Graham Buchanan Westmacott, of Newcastle-upon-Tyne, impts. in hydraulic engines.  
1713. William Virgo Wilson, of Jubilee-street, Mile-end, impts. in the manufacture of red coloring matter.  
1714. Robert Agate, of Hornsey, impts. in the construction of sky-lights and roof-lights for railway stations, conservatories, and other similar structures.  
1715. William Edward Newton, of Chancery-lane, impts. in barometers or gauges for measuring the pressure of fluids,—a communication.  
1716. William Tent, of Birchin-lane, impts. in pins or hooks for suspending fabrics, dresses, or parts of dresses, curtains, and other articles of upholstery or apparel.  
1717. George Gowland, of Liverpool, impts. in the construction and arrangement of nautical and surveying instruments for measuring angles and altitudes.  
1718. William Tasker, the younger, of the Waterloo Iron Works, near Andover, impts. in thrashing machines.

*The above bear date July 9th.*

1719. Peter Augustin Godefroy, of Shepherd's-lane, Homerton, impts. in the mode of purifying oils.  
1720. Alexander Robert Johnston, of Yoxford, impd. portable fence for

- sheep and cattle pens, or for other enclosures.
1721. Marc Antoine François Menons, of Paris, impts. in the mode of preserving and protecting the silvering of mirrors,—a communication.
1722. James John Shedlock, of Abingdon-street, impts. in the construction of soil pits, and in the mode of emptying the same,—a communication.
1723. Charles de Bergue, of Manchester, impts. in piles for foundations, and in piers for bridges and other buildings or structures.
1724. William Clarke, of Nottingham, impts. in the manufacture of ornamental lace.
1726. Richard Hornsby, junior, John Bonnal, and William Astbury, of Grantham, impts. in traction engines, and in apparatus for ploughing and tilling land by steam and other power; part of which improvements is also applicable to driving or giving motion to machinery.
1727. William Edward Jones, of Wellington-road, Clapham, impts. in the permanent way of railways.
1728. William Henderson, of Kensington, impts. in treating ores and other substances containing iron, in the manufacture of iron, steel, and alloys of iron, and of a purifying and deoxidizing agent therefrom; also in the construction of retorts or kilns for treating the said ores and substances.
1729. John Peter Bourquin, of New-man-street, impd. construction of rolling press.
1730. James Campbell, of Silvertown, Essex, impts. in the permanent way of railways, and in supporting the rails thereof.
1731. Robert Hawthorn and William Hawthorn, of Newcastle-upon-Tyne, impts. in the working of railways.
- The above bear date July 10th.*
1733. Edwin Daniel Chattaway, of New Broad-street, impts. in railway signals.
1734. Morris West Ruthven, of Oxford-terrace, Hyde-park, impts. in rudders or apparatus for steering vessels.
1735. Adam Dixon, of Harborne, Staffordshire, and Josiah Pumphrey, of Birmingham, a new fastener or holder for flowers or other decorations to coats and articles of dress.
1736. John Orr, John Brinton, and John Lewis, of Kidderminster, impts. in weaving "chenille," and in the machinery or apparatus connected therewith.
1737. John Barnes, of Nottingham, machine for clipping off connecting threads in the manufacture of lace.
1738. Richard Archibald Brooman, of Fleet-street, impts. in cartridges for breech-loading arms,—a communication.
- The above bear date July 11th.*
1740. James Mortimer, of Hoxton, impts. in the construction and arrangement of dwelling-houses, in combination with the means employed for ventilating the same.
1741. Robert Doyne Dwyer, of Warrington, impts. in the construction of vents for casks and other vessels.
1742. Henry Coulter, of Liverpool, impts. in the burners of hydrocarbon and other fluid-burning lamps.
1743. Robert Doyne Dwyer, of Warrington, impts. in the construction of letter copying presses.
1744. Horatio Nelson King, of Bath, impd. mode of, and apparatus for, producing spectral illusions on the stage.
1745. Joseph Barton, of Alfreton, impd. guard or fence for coal, iron, stone, or other pits, warehouse or other lifts, sack-holes, or other places requiring a guard or fence.
1746. Robert Stocks Walker, of Wapping, impts. in sheathing or coating iron ships.
1747. George Henry Barber, of Southampton, impd. calendar or date-denoting apparatus.
1748. James Laing, of Manchester, impts. in dyeing and printing,—a communication.
1749. Richard Archibald Brooman, of Fleet-street, impts. in apparatus for suspending chandeliers, gaseliers, and other weights,—a communication.
1750. Richard Archibald Brooman, of Fleet-street, impts. in sizing or

gumming warp and weft threads,—  
a communication.

1751. Pierre Charles Alexandre Jodocius, of Dunkerque, impts. in fishing, and in the apparatus or means to be employed therein,—a communication.

*The above bear date July 13th.*

1753. Louis Marcel Bournique and Jean Baptist Vidard, of Paris, impts. in railway carriages.  
1754. Louis Marcel Bournique and Jean Baptiste Vidard, of Paris, impd. waggon or trunk to be used on railways.  
1755. Joseph Rock Cooper, of Birmingham, impts. in sights for rifles and other fire-arms.  
1756. Carl Oppermann, of King's-road, Peckham, impts. in means or apparatus to facilitate the connecting and disconnecting horses and other animals with carriages.  
1757. John Thomas Cooke, of Leicester, impts. in, and connected with, battens for driving shuttles from side to side of their work in weaving.  
1758. James Holmes, George Thomas Holmes, and Frederick Robert Holmes, of Norwich, impts. in thrashing and dressing machines.  
1759. George Saxon, of Openshaw, impts. in metallic pistons.  
1760. James Davison, of Southwick, near Sunderland, impts. in furnaces for boilers, smelting, and other useful purposes.  
1761. Richard Hornsby, jun., and James Edwin Phillips, of Grantham, impts. in reaping and mowing machines.  
1762. William Wood, of Monkhill, near Pontefract, impts. in warping or covering land, bog, or peat with earth or soil.  
1763. Edward Sonstadt, of Loughborough, impts. in the manufacture of sodium.  
1764. William Roberts, of Lylands Twyford, near Winchester, impts. in ploughs.  
1765. James Logan Todd, of Belfast, impts. applicable to the rollers of machines employed for spinning fibrous materials whilst in a wet state.  
1766. James Slater, of Plaistow, impd.

machinery for compressing bricks, tiles, and other plastic materials.

*The above bear date July 14th.*

1767. Edward Funnell, of Brighton, self-acting electro-magnetic clock-work signal for railway purposes.  
1768. Thomas Wimpenny, of Holmfirth, impts. in machinery or apparatus for roving and spinning wool, cotton, and other fibrous substances.  
1770. William Thomas Cheetham, of Ashton-under-Lyne, impts. in obtaining hydraulic motive power.  
1771. William Clark, of Chancery-lane, impd. process for making paper transparent and transferring designs,—a communication.  
1772. Pierre Antoine Joseph Dujardin, of Paris, impts. in electric telegraphs.  
1773. Michael Henry, of Fleet-street, impts. in figuring, ornamenting, and coloring fulled and felted fabrics and articles,—a communication.  
1774. Richard Archibald Brooman, of Fleet-street, impd. means of, and apparatus for, reducing charcoal and other friable substances to fine or impalpable powder; particularly applicable to the manufacture of a substitute for lamp black,—a communication.  
1775. Richard Archibald Brooman, of Fleet-street, impts. in apparatus for telegraphing by electricity,—a communication.  
1776. Doctor Christian Gustav Clemm, of Dresden, new employment of magnesia, and its combinations in manufactures.  
1777. Dominique Tamet, of Neuilly-sur-Seine, France, impts. in breakwaters, and in the construction of rail and other ways thereon.  
*The above bear date July 15th.*  
1779. Andrew Watson, of Glasgow, impts. in cooking ranges.  
1780. Samuel Aylett Cooper, of Chapman-street, St. George's, East, impd. packing cases to contain bottled beer, wine, or any other liquid in bottle.  
1781. Joseph Needham Tayler, of Brixton, and William Austin, of Milford, South Wales, impts. in the



- construction of ships and other floating bodies.
1782. Henry Elliott, of Birmingham, impts. in breech-loading fire-arms.
1783. Lister Priestley, of Bradford, and Joseph Longley Todd, of Morley, both in Yorkshire, impts. in the manufacture of elastic boots and shoes, and in apparatus used therefor.
1784. Louis Rudolph Bodmer, of Thavies-inn, the manufacture of a new product from peat and peat tar,—a communication.
1785. Charles Stokes, of Leigh Sinton, Worcestershire, impd. expanding and contracting horse collar.
1786. George Rand, of Stoneham, Hants, impts. in the means of, and apparatus for, boiling and cooking.
1787. John Lamb and Samuel Tovey, both of Kidderminster, impts. in looms for weaving carpets.
1788. Agatha Montleart, of Mildmay-park, and William Tent, of Birchington-lane, impd. mode of attaching hooks to furniture or fabrics for suspending dresses or parts of dresses, fabrics, curtains, and other articles of upholstery or apparel.
1789. Benjamin Lambert, of Lothian-road, Camberwell, impts. in the preparation of waste paper, in order to its being again used in the manufacture of paper.
1790. Obed Wakefield, of Union-place, Lambeth-road, impts. in cocks or taps.
1791. Nathan Thompson, of Abbey-gardens, St. John's-wood, impts. in boat building, and in machinery for shaping wood therefor.
1792. Edwin Maw, of Leamington, impts. in the manufacture of pillars, posts, columns, mouldings, and buildings, when corrugated metal is employed, and in machinery used in corrugating, moulding, and shaping metal for such purposes.
- cleaning metals, and also for powder.
1796. Felix Lepoutre, of Tour France, mechanical sector, app. to all self-acting machinery us spinning textile fabrics.
1797. Thomas Johnson, of Hai Suffolk, impts. in machiner washing and cleansing casks.
1798. Emile Alcan, of King-City, impts. in gas burners,—a munication.
1799. Richard Archibald Broom Fleet-street, impd. varnish for serving metal and wood,—a communication.
1800. George Fergusson Wilso George Payne, of Battersea, in the manufacture of soap.
1801. Richard Coenen, of Old 1 street, impts. in machinery for ing, measuring, and sizeing si communication.
1802. John Henry Johnson, of coln's-inn-fields, impts. in m knitting needles, and in mac or apparatus for making the sa a communication.

*The above bear date July 17t*

*The above bear date July 16th.*

1793. Angelo James Sedley, of Regent-street, impts. in the canopies of bedsteads of metal or wood, or both combined, and other articles of furniture used to sit or recline upon.
1795. Jean Darrieux, of Candéran, France, pounded glass powder for
1803. Alexander Clark, of Gate-Lincoln's-inn-fields, impts. in r ing shutters and blinds, and in ratus for the manufacture of the
1804. William Charles Page, o brick-street, Millwall, impd. of preventing and removing t crustations of marine and land boilers.
1805. Ethelbert Holborow, of Bu ham-street, Fitzroy-square, and Parker, of Haughton-street, market, impts. in the construct sights for fire-arms.
1806. George Murdoch, of Portsr impts. in the construction of and vacuum gauges.
1807. Frederick Joseph Mavor, of street, Grosvenor-square, imf horse shoes.

*The above bear date July 18t*

1808. William Simpson and John ton, of Northampton, impts. manufacture of hollow cutting
1809. Francis Alton Calvert, of chester, impts. in machiner

opening, clearing, and preparing fibrous substances.

1810. Robert Benjamin Brassey and James Hargreaves, of Ashton-under-Lyne, impts. in machinery or apparatus for sizing and drying yarns and fabrics.

1811. Thomas Knowles, of Hulme, impts. in machinery for opening, carding, and cleaning cotton, and other fibrous materials, when in a manufactured or partially manufactured state.

1812. John Bailey and William Henry Bailey, of Salford, impts. in apparatus for the prevention of boiler explosions.

1813. Augustus Smith, of Stratford, Essex, impts. in machinery for dragging bristles, applicable also to drawing, or sorting fibres and hair into different lengths.

1814. William Edward Gedge, of Wellington-street, impts. applicable to inland navigation,—a communication.

1815. Antoine Alexander Pelaz, of Lyons, impts. in printing stuffs, and other fibrous fabrics.

1816. Frederick Ayckbourn, of Moreton-street, impts. in air and water beds, pillows, bolsters, and cushions.

1817. Josiah Lyman, of Thavies-inn, impts. in micrometer draughting scales.

1818. Robert Weare, of Northwood, Stoke-upon-Trent, impts. in water-closets, commodes, slop pails, and other like apparatus or utensils.

1819. Joseph Goold, of Corsham, Wilts, impts. in the manufacture of ink.

*The above bear date July 20th.*

1820. Frederick Ludwig Hahn Danchell, of Red Lion-square, impts. in apparatus for purifying water.

1822. William Clarke, of Nottingham, impts. in the manufacture of fabrics in twist lace machinery.

1823. William Lyle Aberdein, of Belfast, impd. machinery for breaking or softening and preparing flax, hemp, jute, tow, and other fibrous substances.

1824. Charles Stewart Duncan, of Inverness-road, Bayswater, impts. in the means of, and apparatus for, heating, melting, boiling, evaporating, and other useful purposes.

1825. Edward Thomas Bainbridge, of St. Paul's Churchyard, impts. in ventilators.

1826. James Engleburtt Vanner, of Coleman-street, impts. in the manufacture of umbrellas and parasols.

1827. George Haseltine, of Southampton-buildings, impd. implement for harrowing and smoothing land,—a communication.

1828. Richard Archibald Brooman, of Fleet-street, impts. in watches and other time-keepers,—a communication.

1829. Emile Alcan, of King-street, City, impts. in apparatus for condensing steam,—a communication.

1830. William Naylor, of Queen's-road, Dalston, impts. in safety valves, and in apparatus connected therewith.

1831. William Edward Newton, of Chancery-lane, impts. in the manufacture of mats, floor cloths, or coverings for floors; straps, bands, ropes, and other analogous articles, which are usually made of textile or fibrous materials,—a communication.

*The above bear date July 21st.*

1832. Peter Rothwell Jackson, of Salford, impts. in machinery for rolling hoops and tyres.

*The above bear date July 22nd.*

## New Patents Scaled.

209. Charles Stopford.  
223. R. A. Brooman.  
237. William Rollason, jun.  
239. Joseph Edmondson.  
241. D. E. Hughes.

248. J. Oglesby, J. Dickinson, W. M. Dickinson, and J. Dickinson, jun.  
249. H. O. Cook and E. G. Terrey.  
251. Robert Ward.  
254. William Conisbee.

255. S. W. Francis.  
 258. C. P. Stewart and J. Robinson.  
 261. B. I. Bromwich.  
 273. Gideon Blake.  
 283. W. E. Gedge.  
 286. Thomas Bennett.  
 295. Alexander Forbes.  
 296. W. C. Barnes.  
 299. William Clark.  
 304. J. Fletcher and H. Bower.  
 305. A. T. Blakely and J. Vavasour.  
 310. James Mellor.  
 312. Thomas Bradford.  
 315. J. J. Hays.  
 316. L. J. H. Marville.  
 318. W. T. Weston.  
 319. Barnabas Russ.  
 324. Joseph Gill.  
 328. R. A. Brooman.  
 330. R. A. Brooman.  
 334. Alexander Johnston.  
 337. R. A. Brooman.  
 339. John Price.  
 342. John Cameron.  
 345. George Turner.  
 351. Matthew Hackforth.  
 352. George Redrup.  
 354. B. Dobson and E. Barlow.  
 357. D. Law and J. Downie.  
 358. John Goucher.  
 361. J. Crosby and J. B. Smith.  
 362. Thomas Hill.  
 363. Robert Burley.  
 364. Montague Wigzell.  
 365. Matthew Cartwright.  
 366. J. F. Bottom.  
 367. W. Whitaker and W. Tongue.  
 368. Alfred Corneau.  
 369. Hugh Donald.  
 370. E. T. Hughes.  
 371. John Duckworth.  
 374. Robert Saunders.  
 375. William Symington.  
 376. R. A. Brooman.  
 378. Henry Wycherley.  
 385. G. H. Birkbeck.  
 386. S. Mount Cashel Innes.  
 388. Jabez Jones.  
 389. J. F. Spencer.  
 390. James Robertson.  
 392. William Robertson.  
 393. G. Wrigley and S. Morris.  
 394. O. H. Hodge.  
 396. Samuel Whitaker.  
 400. W. C. Paul and A. T. Shore.  
 401. J. S. Gisborne and W. Simpson.  
 403. W. Baylis and T. H. Hopwood.  
 410. J. and H. Higgins.  
 413. J. H. Johnson.  
 415. J. W. Crossley.  
 416. C. D. Abel.  
 420. R. A. Brooman.  
 423. S. W. Clough.  
 424. William Nalder.  
 426. F. T. W. Salmon.  
 430. Josiah Gimson.  
 431. Estève Deville.  
 432. James Durrant.  
 438. Edward Strawson.  
 442. J. F. Spencer.  
 443. J. H. Bly.  
 448. G. T. Bousfield.  
 449. Josiah Puntis and George Cox.  
 452. T. Markland and J. C. Dickinson.  
 459. H. B. Barlow.  
 461. William Marsden.  
 462. Charles Billingsley.  
 463. J. Bentley and H. Booth.  
 464. C. W. Siemens.  
 466. Richard Bell.  
 480. Herbert Mackinder.  
 481. John Brown.  
 489. J. P. F. Datchy.  
 499. John Clay.  
 513. G. Bower and W. Hollingshead.  
 518. Robert Maynard.  
 520. Joseph Fitter.  
 528. T. V. Lee.  
 559. William Clark.  
 561. J. H. Johnson.  
 582. E. Habel and E. Sucklow.  
 643. A. V. Newton.  
 667. William Wood.  
 691. William West.  
 708. W. E. Newton.  
 714. W. H. Emmett.  
 749. G. Coles, J. A. Jaques, and J. A. Fanshawe.  
 786. G. F. Key.  
 808. B. W. Goode.  
 895. F. J. Risse.  
 903. George Low.  
 929. Robert Reeves.  
 974. T. A. Weston.  
 1080. William Rodger.  
 1091. E. G. Brewer.  
 1117. R. G. Kent.  
 1163. W. E. Gedge.  
 1167. William Boaler.  
 1216. L. S. Chichester.  
 1251. J. H. Johnson.  
 1256. Abraham Parker.  
 1418. G. W. E. Friederich.  
 1456. James Webster.

\* \* \* For the full titles of these Patents, the reader is referred to the corresponding numbers in the List of Grants of Provisional Specifications.

# NEWTON'S

## London Journal of Arts and Sciences.

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No. CVI. (NEW SERIES), OCTOBER 1ST, 1863.

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### THE PATENT OFFICE AND ITS DUTIES.

report of the Commissioners of Patents for Inventions for the 1862, recently issued, contains nothing of novelty calling for remark; the only point of interest consisting in the fact that the revenue of the patent office is well maintained. This is, however, a matter of considerable moment at the present time, for it must be remembered that we are on the eve of great changes in the administration of the patent laws: that is, if the labours of the Royal Commission, which worked most diligently last session, are to produce any satisfactory result; and if the almost unanimous dissatisfaction evinced in the present manner of trying patent causes is to have any weight with the legislature. Great expectations have been raised, and not without reason, by the forthcoming report of the Royal Commission, although it is not our intention—for it would be a vain endeavour—to anticipate its contents, we may remark that, inasmuch as a list of questions, prepared for the purpose of eliciting evidence, covers in a very wide range of subjects, it is only reasonable to suppose that the forthcoming report will embrace the same extended range of enquiry. That being so, it is not improbable that the Commission may recommend the imposition of new duties on the patent office; and as the performance of new duties involves increased expenditure, it is satisfactory to know that the state of the exchequer is such as to warrant an extension of the current expenses. We have frequently, in this Journal, referred to the receipts and expenditure of the patent office, and shown the rapid increase of the latter and the smallness of the former; and we think it is the more important that the state of the account should, at this time, be well understood by the public; and we have reason to hope, as above intimated, that a call will shortly be made on the patent office funds, for the benefit of patentees, and we cannot forget the recent statement of the Chancellor of the Exchequer, during the discussion on the establishment of a museum of natural history.

OL. XVIII,

patent inventions at South Kensington, to the effect that the large sum representing the total surplus income of the patent office, had been absorbed into the general revenue account of the United Kingdom, and had therefore disappeared. Notwithstanding this quiet disposal of the fund, the patent office has a fair claim against the country to the amount of the sum absorbed; and it is well that patentees should remember the fact, in case the exigencies of the patent office should at some future time be such as to require the assistance of Parliament.

The following is a tabulated statement of the receipts and expenditure of the patent office, from the commencement of the working of the Act of 1852 to the end of the year 1862, showing a total surplus revenue of £334,210. 9s. 5d., which sum may be expected to increase at the rate of £60,000 per annum.

|                                                 | Gross Revenue. |    |    | Current Expenses. |    |    | Surplus Revenue. |    |    |
|-------------------------------------------------|----------------|----|----|-------------------|----|----|------------------|----|----|
|                                                 | £.             | s. | d. | £.                | s. | d. | £.               | s. | d. |
| From Oct. 1st, 1852, }<br>to Dec. 31st, 1853. } | 72,911         | 8  | 6  | 47,599            | 12 | 9  | 25,311           | 15 | 9  |
| 1854                                            | 53,864         | 18 | 2  | 63,504            | 8  | 6  | (deficit)        |    |    |
| 1855                                            | 74,819         | 1  | 4  | 51,742            | 11 | 0  | 23,076           | 10 | 4  |
| 1856                                            | 92,477         | 6  | 2  | 65,762            | 10 | 9  | 26,714           | 15 | 5  |
| 1857                                            | 85,351         | 2  | 3  | 77,749            | 8  | 3  | 7,601            | 14 | 0  |
| 1858                                            | 84,952         | 15 | 6  | 61,788            | 4  | 4  | 23,164           | 11 | 2  |
| 1859                                            | 96,804         | 8  | 5  | 44,398            | 6  | 3  | 52,406           | 2  | 2  |
| 1860                                            | 109,571        | 18 | 6  | 43,833            | 10 | 9  | 65,738           | 7  | 9  |
| 1861                                            | 102,030        | 17 | 0  | 46,567            | 13 | 3  | 55,463           | 3  | 9  |
| 1862                                            | 111,729        | 15 | 6  | 47,356            | 16 | 1  | 64,372           | 19 | 5  |
|                                                 |                |    |    | (Deduct deficit)  |    |    | 343,849          | 19 | 9  |
|                                                 |                |    |    |                   |    |    | 9,639            | 10 | 4  |
| Total ... ..                                    | £384,513       | 11 | 4  | £550,303          | 1  | 11 | £334,210         | 9  | 5  |

In their last report, the Commissioners embody the report which they transmitted to the Treasury in August, 1862, on the subject of the building of a patent office, public library, and museum, and which has already been commented on in this Journal. That report embraces, as will, perhaps, be remembered, a rather ambitious project, viz., the acquirement of Fife House and gardens, in Whitehall, with a large slice of land, to be recovered from the Thames, in the process of making the embankment, between Westminster and Blackfriars bridges. This would give a frontage, in a new street, of over 400 feet, and a river frontage of nearly 200 feet; the intention being to cover the whole ground, in due time, with buildings, which should provide a patent office, library, and museum. But great as is this project, it sinks into insignificance in comparison with the scheme announced by the Premier

last session, by which four-and-a-half acres of covered space was to be appropriated for a museum of patent inventions.

A suitable building for carrying on the business of the office is undoubtedly a pressing necessity, but what is far more important is an efficient staff, for administering the duties of the office. What are the duties properly belonging to the office, is a subject to which it may not be unreasonable to direct attention; for it will be too late when the Government is committed (if that should ever be the case) to an inefficient plan of reform. Already, since the passing of the Act of 1852, most important changes have been introduced, not merely in respect of the mode of granting patents and the cost of obtaining them, but the patent office has recognised the duty of making all kinds of scientific information accessible to the public, and particularly the specifications of patents. To this end, the specifications are not only published at cost price, but they are open to the public in a free library, as are also chronological, alphabetical, and subject matter indexes; together with abridgments of specifications, arranged chronologically, and according to their subjects. These facilities contrast most favorably with the old practice, before the institution of a patent office. At that time, not only was it left to private hands to inform the public what patents were granted, but the greatest obstacles existed to the acquirement of a competent knowledge of the state of invention in any given branch of industry. The specifications were scattered by being enrolled in one or other of three offices, where subject matter indexes were unknown; and in neither of the three offices could information be obtained as to where a missing specification was to be found; or indeed whether the specification, of which the enquirer was in search, had ever been enrolled. At each office, a fee, varying from 1*s.* to 3*s.* 6*d.*, was required for every inspection of a specification, and for every enquiry, whether it resulted in an inspection or not, a fee was demanded. Moreover, it was considered a high crime and misdemeanour to take notes or extracts of specifications; because the offices were thereby defrauded of the profits derivable from office copies, which commonly cost from three to thirty guineas each. This vested right, it is true, was seriously interfered with by the present Master of the Rolls, who so far anticipated the present liberal policy, of enabling men of practical science to become familiar with the labours of their predecessors, as to allow copies, in pencil, of all specifications on the record at the Rolls Chapel Office, to be taken on the payment of a fee of 1*s.*; but at the Petty Bag Office and the Inrolment Office, the exclusion system prevailed, until the printed specifications were placed in the hands of the public.

It is no secret, that the various changes by which inventors obtained

increased facilities for discovering the state of public knowledge in manufacturing industry were inaugurated at the instance of Mr. Woodcroft, who, from a long and severe experience as an inventor and patentee, knew but too well the enormous disadvantages under which inventors labored in making a profitable investment of their ingenuity. Whether his labours have been properly seconded is another matter. Our opinion is, that much is yet wanting to render the patent office staff equal to the duties which it has undertaken, to say nothing of other duties which patentees may now, not unreasonably, expect shall be performed. In our review of the *Abridgments of Specifications*, in the Journal for October, 1859, such evidence of carelessness and incompetency, in the preparation and supervision of those little works, was adduced, as proved their untrustworthiness, and consequent inutility. At that time, the specifications of only fourteen subjects had been abridged, but now the number has doubled, with little improvement, we fear, in the quality and completeness of the abstracts. The fact is, the office is yet without a controlling head other than the Commissioners, whose meetings for business, we learn by a recent return, were limited to four, during the year ending 31st March, 1860, and who could never act otherwise than as referees. Whereas, for the preparation of these manuals, and for the keeping up of subject matter indexes, the constant supervision is required of some responsible officer, practically acquainted with the nature of the work in hand. The faculty of condensing into a few words the characteristic features of an invention, is no doubt a rare one; but the power of eliminating the nature of an invention, and setting it forth in abstract form, is certainly not so rare as to be unattainable by the patent office. So long, however, as no means of supervising the abridgments exist, so long will the abridgments—no matter how able the collaborators employed—present a want of system and uniformity. Thus, information will creep into one division where not wanted, and, through its presence, create disappointment, by reason of kindred information, equally irrelevant, being absent; while other matters, which should have appeared, will be omitted, and, for some insufficient cause, find a place under a wrong head. It is unnecessary to repeat the examples which we gave in the review already referred to of errors of misplacement and omission, but a glance at these will fully explain the meaning of our remarks, and show also the only means of avoiding those errors.

Before, however, entirely satisfactory abstracts of the specifications of inventions can be made, the specifications themselves must take a shape which it is the tendency of the recent decisions of our Courts to discourage. So far from its being now considered desirable to state clearly and explicitly the nature of the invention which the specifica-

tion by statute is required to disclose, the very opposite course is taken; and it is considered a merit so to fog the description of a machine or process in respect of its old and new features, as to hide the essence of the invention, while clearly describing the machine or process. The duty is thus put upon the Courts to determine for what the patent was granted; and this duty we are bound to say the learned judges have taken to very kindly ever since the decision of the case *LISTER v. LEATHER* inaugurated the practice. From specifications thus framed it is no easy task, even for gentlemen intimately acquainted with the manufacture to which they refer, and also with the law that rules their interpretation, to frame satisfactory abstracts: for one not thus qualified the task is hopeless. If, then, reliable abstracts are difficult to obtain from complete specifications, much less can they be made from provisional specifications; yet these are absolutely necessary, if, in compliance with the suggested reform in the practice of the office, a comparison is to be made between the closed provisional drafts and new applications, with the view of satisfying inventors as to whether or not they are anticipated by an unspecified patent.

From the above remarks, it follows that we require an amendment in the practice of preparing both provisional and complete specifications; but how is this to be effected unless those who undertake the duty to interpret these documents have the power of controlling in some sort their construction? Let us suppose it was the duty of those gentlemen who now examine provisional specifications for their sufficiency, to prepare also abstracts of the inventions for office and public use, and granting that they were fully competent to follow the descriptions—in what proportion of cases could they with any confidence set down the subject matter of the invention? We will venture to say not one in ten. Such being the case, it follows that any examination by the patent office in respect of novelty must be a mere farce; and what is still more detrimental to the interests of the public is, that of the claims of numerous patents no reliable interpretation can be obtained, except through the medium of a series of law suits; it being in the power of patentees to shift their ground to suit the various cases which they propose to allege as infringements.

These are some of the difficulties which a proper organization of the patent office might very easily remove; but so long as the duties of administration are scattered, such evils must necessarily continue. If, in accordance with an almost universal desire, a special court is to be established for deciding cases of alleged infringement of patents, for confirming patents, and considering applications for extensions, it follows that the only ground for continuing the practice of referring applications for grants of patents to the law officers,—viz., because the



work thus thrown upon them specially qualifies them for administering patent law on the Bench—is cut away. This being so, the duties of examining and approving or rejecting applications might well be transferred to permanent officers, having appropriate scientific qualifications; who, in addition, should take the responsibility of preparing, with the aid of proper assistants, indexes and abstracts of specifications. Another and most important officer is also required, whose duty should be, first, to examine all *ex parte* cases of alleged infringement, with the view of determining whether or not a process shall be issued for trying the case; and, secondly, in the event of a sufficient *prima facie* case being made out, to prepare the case for trial by the assistance of the parties to the cause. The advantages of this course have already been so fully set out in this Journal\* that we forbear to enlarge upon them in this paper. The qualifications of an officer entrusted with these onerous duties must necessarily be of a high order; and it would be only right to allow of an appeal from his decisions. This appeal would most appropriately be made to the judge appointed to preside over a special tribunal for administering the patent laws, and the same authority might also be appealed to by the petitioners for patents, whose applications had been rejected by the examiners of provisional specifications. The judge of the patent court, having thus the power to control the decisions of the higher officers, would become virtually the head of the patent office. He would thus be enabled, not only by his decisions in court, but also by instructing his subordinates, to ensure that provisional specifications should clearly set out the subject matter designed to be patented, and complete specifications would speedily conform thereto. Moreover, if assessors are deemed requisite to assist the judge in trying patent causes, who could be more appropriately selected for that duty than the officers whose functions we have above indicated? Whether the recommendation of the Royal Commission may point to so thorough a reform as the one sketched out, or embrace a less sweeping measure, it will be important to keep in mind the fact, that over and above the sum which is required to provide suitable premises for carrying on the business of the patent office, the revenue of the office is quite equal to the increased annual expenditure which the above suggested appointments would entail.

\* See Vol. V., pp. 65 and 135, and Vol. XVII., p. 326, New Series.

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## THE GHOST IN CHANCERY.

MANY have been the attempts, during the present century, to popularize science; but notwithstanding the continued efforts of philanthropists and capitalists, as evidenced by the establishment successively of the Adelaide Gallery, the Polytechnic Institution, the Alhambra, Leicester-square, and the Crystal Palace, Sydenham, science is still the delight of a very small section of the community. To a certain extent the taste for scientific enquiry is inherent in the young, but with adolescence it has generally disappeared: it is, however, possible that a discovery which has recently attracted very general attention may serve to fix this taste in the rising generation. Hitherto one simple and very characteristic experiment has served to satisfy the aspirations of youth in the direction of practical science. This is no other than bringing to a practical test the truth of the nursery legend respecting the attractive properties of salt (Na Cl.) when applied to the rear extremity of any small specimen of the feathered tribe. Until lately this was the one and only recipe open to young experimentalists to catch shy game; but truly we live in an age of progress, for that most subtle of all visitants—a ghost—has at last been caught by means of PEPPER; and, what is more singular, with the help of the Lord Chancellor, he is held securely under a patent. Although for a while the youth of Great Britain must stay their hands from subjecting this new scientific discovery to a practical test, in due time it will be open to their investigation, and may encourage them to continue the pursuit of science. Lest, however, those of riper years should be led astray by this bold announcement of the marvellous property of Pepper, we would remark that it is not the *Piper nigrum* of Linnæus which has received this novel application, but it is a mental "salt," if we may be allowed the expression,—a combination of two minds, the theoretical and the practical,—which has produced an element so energetic as to call up any desired apparition, and dismiss it at will. Whether this power is altogether novel or not has been stoutly contested, and it was to settle this dispute that the claimants of the discovery called in the aid of the Lord Chancellor.

To support the allegation of novelty, authorities of no less note than Sir David Brewster and Professors Faraday and Wheatstone were brought in evidence, who considered the means used for raising the ghost to be new, and attributed the potency of the spell to the combined action of PEPPER and DIRKS. If those learned scientific gentlemen were deeply versed in dramatic literature, which is hardly to be expected, they might have found a foreshadowing of the use of this compound

in a work of the "immortal bard;" for had Banquo not received, by order of Macbeth, what is vulgarly termed *pepper*, his ghost—the "horrible shadow," the "unreal mockery"—which so appalled the king, would not have displaced the mirth at the royal banquet. Neither can the realization of this ghost to Macbeth's mental vision be dissevered from the shock which his nerves received in what is known as the dagger scene, when the airy *dirks* were presented to him, first with the handle toward his hand, and again with the blade and dudgeon laden with "gouts of blood, which was not so before." This evidence, whether by inadvertence or not, we will not enquire, was not presented to the Lord Chancellor at the hearing; but other evidence, at least as pertinent, was adduced, to impugn the novelty of the invention. Thus, Mr. Alec Palmer, a vocalist, and an early professor of the "bones," before their rattle had resounded in every London street, had raised a ghost of himself, by the aid of the great magician, Herr Döbler, at Tivoli Gardens, Margate, so long ago as the year 1845, and also at Ashford and Sandwich. About the same period, at the Lowther Bazaar, a ghost in armour—probably that of Hamlet's father—was exhibited at 3d. per head. Again, at Cremorne Gardens, in 1852, Mr. De Bosco Hughes had, to the delight of expectant bachelors and spinsters, raised the shadows of their future partners. Lastly, Mr. King, a photographer, of Bath, had, in 1860, for the purposes of his art, raised the phantom. These were, one and all, alleged to have been produced by precisely the same means as that disclosed by the provisional specification, on which the application before the Chancellor was based. His lordship, however, considering that great and irremediable damage might possibly accrue if the petition of the applicants were rejected and the ghost were thereby allowed to wander at large, granted a writ of *quo warranto*, by means of which his shadowy majesty has been deprived of his liberty, and is now held in bondage by the Professor of the Polytechnic Institution. We fear, however, that his powers of ubiquity may give no little trouble to his keepers. For our own part, we would gladly have seen this interesting novelty handed over to our young experimental philosophers, as being admirably suited to their capacities; and it was, no doubt, to some such application of the discovery as this that Professor Wheatstone alluded, in his affidavit laid before the Chancellor, when he said, "It is novel, and, as I consider, also useful;" its usefulness in any other direction, being to us as shadowy as the ghost himself.

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## Recent Patents.

TO HORACE LEE MAN EMERY, of Albany, State of New York, U.S.A.,  
for improved machinery for ginning cotton.—[Dated 4th September,  
1862.]

THE object of this invention is so to improve the construction of saw gins, as to effect the ginning of long and short staple cotton in a more efficient and economical manner than heretofore, and effectually to remove the sand and dust from the cotton.

In Plate VII., fig. 1 is a longitudinal section of the improved saw gin; and fig. 2 is a transverse section of the same. A, A, is the main framing of the machine, at the front of which is a hopper B. This hopper is mounted on a hinged joint *b*, capable of receiving an endway movement, to allow of the position of the hopper being adjusted by the attendant, for the purpose of regulating the action of the saws upon the staple. Within the hopper is mounted loosely a spiked roller *c*, its use being to lap around it the cotton as it is fed into the hopper, and thereby to present the staple in the form of a roll to the action of the saws. This roll may, if desired, receive motion through gearing from the saw shaft, but it is preferred to mount it loosely in the hopper, and make it dependent for its rotation on the contact of the saws with the roll of staple.

The bearings of the spiked roller consist of elongated holes in the ends of the hopper, as shown by dots; the lower edge of the holes being of a segmental form, struck from the axis of the saws, and the upper part being sufficiently concave to allow the roll of cotton to rise, and thereby escape a too severe action of the saws. The inner side or breast of the hopper, is formed, as usual, of a series of upright curved bars *b'*, which are set parallel to each other, and constitute a grid. Between these bars the saws *D*, (set at equal distances apart on a square shaft *d*), project, to take hold of the roll of cotton, and detach the fibres from the cotton seeds. As the saws revolve, they give rotary motion to the roll of cotton in the act of drawing out the fibres therefrom, and as the cotton seeds are stripped of the cotton by its withdrawal from the hopper by the saw teeth, the seeds fall out from the roll, and are discharged through the bottom of the hopper.

The saws are made of hammered sheet steel, and their teeth should be round and pointed, somewhat like a thorn, and rounded and smooth at the bottom angle. Their position is nearly tangential, and they severally lap over the one in advance to the extent of about one-half their length. As fast as the teeth become charged with cotton fibres, they are stripped by a rapidly-revolving brush cylinder *E*, which is mounted in a chamber *F*, in the rear of the line of saws. This brush cylinder, which is intended also to act as a blower, is closed at its ends by annular trough-shaped end plates (see fig. 2), and segmental openings are made in the sides of the chamber *F*, opposite the upper half of the annular trough, to allow of an indraught of air to the chamber. The rapid rotation of the brush cylinder also draws air between the cylinder and a conducting board *f*, forming the bottom of the chamber, against which the cotton is thrown by centrifugal force. From this board the ginned cotton is carried by the action of the blast into an air trunk *G*, connected with the air chamber *F*. In this air trunk a drum of wire-

gauze H, is mounted horizontally, for the purpose of receiving the cotton on its surface in the form of a batt. To this drum a slow axial motion is imparted, for the purpose of conveying the cotton, as it is deposited upon the upper part of its periphery, to a pair of stripping rollers I, I, and presenting a fresh surface to be coated by the cotton discharged into the air trunk. The drum, in its rotation, carries forward the cotton in the form of a thin sheet, and presents it to the action of the blast, the only vent for which is through the wire-gauze drum; the sand and dust contained in the cotton is therefore carried away by the blast, and falling through the drum H, is deposited on the ground. An endless belt, which passes around the stripping rollers I, I, strips the cotton from the drum, and passes it under a smooth pressing roller K, mounted above the stripping rollers, by which means it is delivered in a condensed form, and in a continuous length, out of the machine, as shown.

When the machine is driven by hand, a transverse shaft I, is mounted in bracket bearings at the top of the frame A, to one end of which is attached a winch, and to the other a spur wheel M, with a set of inner and outer teeth. The inner teeth are put into gear with a small pinion N, keyed on to the axle of the brush cylinder, by which a rapid rotary motion is imparted to that cylinder. The outer teeth serve to drive a spur wheel O, on the saw shaft, the opposite end of which shaft carries a small pulley O. A belt from this pulley passes round a pulley P, on the axle of the upper stripper roller I, and thereby imparts rotary motion to those rollers. Keyed to the opposite end of the axle of this roller is a small pulley, from which a belt passes to a large pulley on the shaft of the drum H, and thereby imparts a slow rotary motion to the drum. The direction of rotation of the several acting parts of the mechanism is clearly indicated by the arrows.

In order to adapt the machine when set for short staple to act on long staple cotton, every alternate saw is removed, and replaced by plain discs of the same diameter. By thus increasing the distance between the saws, no two sets of teeth can by any chance act upon the same individual fibres, and therefore the cutting of the long fibres by the saws will be effectually prevented.

The patentee claims, "the general arrangement of machinery above described, for effecting the ginning of long and short staple cotton, and particularly the means above described for presenting the feed cotton to the action of the saws."

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To JAMES TAYLOR, of *Stalybridge, Cheshire*, for improvements in engines for carding cotton and other fibrous materials.—[Dated 24th December, 1862.]

THIS invention relates to the mechanism to be used for the purpose of stripping the carded fibrous material from the doffer cylinder of carding engines, and it consists in the application to the doffer of a combination of a roller and concave straight edge or surface.

In Plate VII., fig. 1 shows the improvement in sectional elevation. A, is the framing; a, part of a doffer; b, delivery rollers, through which the sliver passes when removed from the doffer. The roller c, and concave straight edge or surface d, are carried by framings e, one at each side of the engine. These framings are provided with slots and adjusting

set screws  $e^2$ , by which they may be moved to and from the card surface of the doffer; and they are also provided with screws  $e^3$ , by which they may be firmly secured when adjusted, as will be readily understood. These framings  $e$ , form the bearings for both the rollers  $c$ , and the concave straight edge  $d$ . The roller  $c$ , can turn freely, and the concave straight edge  $d$ , can oscillate freely on its axis  $d^1$ . The roller  $c$ , will strip and drag the fibrous material from the doffer and between itself and the concave straight edge or surface  $d$ , when only slightly roughened; but it is preferred to flute it, in the manner shown. That portion of the concave straight edge  $d$ , in contact with the surface of the flutes, should be made to fit as accurately as possible to the curve described by the tops of the flutes. The flutes of the roller may be adjusted so as to touch the points of the teeth of the card, but it will remove the fibrous material satisfactorily even when at a distance of about one-eighth of an inch from the points of the teeth. The concave straight edge  $d$ , is pressed against the roller by weights  $d^2$ , hung by links  $d^3$ , upon the arms  $d^4$ , projecting from the concave straight edge. The pressure required upon the roller  $c$ , is but slight. Upon the upper side of the roller  $c$ , a "clearer"  $f$ , is placed; it is formed, by preference, of metal not too heavy, and is covered on its concave side by flannel or other suitable material. The clearer  $f$ , rests upon pins  $f^1$ , in the framings  $e$ , (one at each end) so as to be able to rise if the roller  $c$ , should happen to "lap," or become covered with fibrous material. Sometimes small "lumps," or pieces of dirt will collect at the nip of the concave straight edge  $d$ , and roller  $c$ , and are kept back and prevented from passing with the fibrous material. For the purpose of releasing such small lumps, the arms  $d^4$ , from the concave straight edge  $d$ , are made to project, so as to form handles, by raising which slightly the lumps of dirt will be released, and will pass along with the fibrous material. An adjustable set screw  $e^4$ , is used to limit the ascending movement of the handle. The rollers  $c$ , may be driven by any convenient arrangement of mechanism. It is preferred to drive it by an endless band, as its surface speed and that of the doffer need not be exactly equal; in fact, the mechanism operates satisfactorily when the surface speed of the roller  $c$ , is either a little greater or a little less than the surface speed of the doffer  $a$ .

Sometimes, but rarely, the fibrous material, from the accidental presence of some gummy matter, will lap upon the roller  $c$ , and if this takes place, and the material accumulates upon the roller to any considerable extent before being observed, it may damage the card surface of the doffer. To provide against such an accident, it is preferred to make a gap in the framings  $e$ , forming the bearings of the roller  $c$ , as shown in fig. 2 (which is a sectional elevation of the mechanism), which leaves the roller  $c$ , free to retire from the card surface as the material accumulates. The driving band is sufficiently slack to permit the extent of movement required. A stop  $e^5$ , is arranged to prevent the arm from descending too low, see fig. 1. The weight of the roller will be sufficient to keep it in its correct position, but, if required, springs may be added so as to press upon its bearings. Instead of a flat clearer  $f$ , as shown in fig. 1, a cylindrical clearer  $f$ , may be used, arranged to rotate in bearings in the framings  $e$ , and so as to be capable of rising; and this clearer may be driven so that its surface will move either slower or faster than the surface of the roller  $c$ , or in an opposite direction to it, by an endless band from the axle of one of the delivery rollers  $b$ , as shown.

Fig. 2, and also fig. 3, show the concave straight edge *d*, made into a lever, with the mass of material at one side of its fulcrum *d*<sup>1</sup>, preponderating over that on the other side, so as to give sufficient pressure against the roller without detached weights. Fig. 2 shows the adjusting screw *e*<sup>1</sup>, to prevent the end in contact with the roller *c*, from touching the surface of the doffer *a*. The modification shown in fig. 3, is one in which the concave straight edge or surface *d*, is made of elastic metal, so as to conform more easily to the surface of the roller *c*.

The patentee claims, "the combination of a roller and concave straight edge or other equivalent surface, acting substantially in the manner and for the purpose described."

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*To THOMAS RICHARDS HARDING, of Leeds, for improvements in machinery for carding and combing flax, wool, cotton, and other fibrous substances.*  
—[Dated 23rd February, 1863.]

THIS invention relates to the application of drawing-off rollers or other similar apparatus to cylinders covered with teeth, or other carding surface, for the purpose of drawing off and separating the longer and more valuable portion of the material under operation, both from that portion which is shorter in the fibre and partakes more of the nature of noil, and also from all impurities and refuse.

The figure in Plate VIII. is a sectional elevation of a carding engine, for operating upon tow or such like material. *a, a*, is the framing; *b*, the main cylinder, which receives its motion from a pulley, fixed upon its axle, or in any other convenient manner. The fibrous material to be operated upon is placed upon an endless apron or feeding sheet, or it may be introduced to the feed roller *c*, in the form of a sliver. The fibrous material is delivered to the action of the teeth on the main cylinder *b*, *b*, by the feeding roller, and is acted upon by a series of workers *d, d*, and strippers *e, e*, which operate in the usual manner.

The motion of the main cylinder *b*, lashes the material on to the first worker *d*, where, one end of the fibres being firmly held, the other will be combed out by the teeth of the cylinder *b*. The fibres will thus be left in the teeth of the worker; the combed end projecting at a tangent therefrom, and forming a kind of fringe or beard on the surface of the roller. The fibres are taken off the worker *d*, by the stripper *e*, and are again brought on to the main cylinder *b*; and the like action takes place with all the workers and strippers.

The material, after being operated on by all the workers, arrives at the doffer cylinder *f*, which differs from the workers only in this—that the pins of the doffer *f*, are finer and closer set than those on the workers. The material is finally taken by the doffer out of the card or large cylinder *b*, which rotates at a higher surface speed than the doffer. The doffer cylinder *f*, is driven at a low rate of speed, for the two-fold purpose of accumulating in its teeth the fringe or mass of fibres, so that they may be well acted upon and combed by the main cylinder, and also to give a certain consistency to the sliver, which might otherwise become attenuated and prevented from holding together, on account of the greater surface speed of the drawing-off rollers *g, g*.

These rollers are made the whole width of the machine, and work in

suitable bearings, they being pressed together by springs or weights. The bottom roller may be fluted, and the top one covered with leather, India-rubber, wood, or other suitable material.

In consequence of the superior speed of the drawing-off rollers *g, g*, the protruding ends of the fringe of fibres on the doffer are seized by the drawing-off rollers, and are thereby combed or drawn out continuously from and against the teeth of the doffer, leaving the noils and impurities sticking in the doffer. The noils and refuse are taken off the doffer by means of a rotary brush *h*, or by means of a doffing knife or other suitable apparatus, which will collect them separately, and convey them out of the machine, as at *i*.

An obvious modification of this invention will be to feed the fibres or material to be operated upon on to a separate porcupine or card, or comb cylinder or series of rotating combs, and adapt thereto a doffing cylinder *f*, and drawing-off rollers *g, g*, whereby the long fibres will be drawn off or combed precisely in the manner already described.

In some cases it may also be needful to have additional clearing or combing cylinders to act upon the fringe hanging from the doffer *f*, or a brush may be employed as at *j*, in order to press the ends of the fringe or beard hanging from the doffer cylinder *f*, against the teeth of the main cylinder *b*.

The patentee claims, "combing fibrous materials by means of a doffer and drawing-off or combing rollers, adapted to card or porcupine cylinders, or rotating combs or comb cylinders, as above set forth."

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To ABRAHAM BAMFORD, RICHARD BLOMLEY, ROBERT TAYLOR, and JAMES LETT, *all of Rochdale, Lancashire, for improvements in looms for weaving*.—[Dated 2nd January, 1863.]

HITHERTO, in looms for weaving, it has been customary to connect the picking stick, when it has not moved with the lathe, to the picker by means of a strap, band, or chain. Now this invention consists in connecting the picker to the picking stick without the intervention of the strap, band, or chain.

In Plate VIII., fig. 1 represents an end elevation of a loom, such as is used to weave calico, with the invention applied; and fig. 2 represents a front elevation of one end of the same. *a*, is the frame side of the loom; *b*, the driving or crank shaft; *c*, the tappet shaft, on which is mounted the tappet *d*, which works against the bowl *e*, and causes it to vibrate to and fro. This bowl is mounted on a stud *e'*, which is screwed fast to an upright shaft *f*, supported by the brackets *f'*, and *f''*. The shaft *f*, carries at top a plate *g*, to which is fastened the picking stick. *h*, is a spiral spring, which keeps the bowl *e*, against the tappet *d*; *i*, is the lathe; *k*, the shuttle-box bottom, which has a slot in it, for the end of the picker to slide in; *l*, is the shuttle-box front; *m*, the shuttle-box back, and *n*, the spindle on which the picker slides. *o*, in fig. 2, is the shuttle-box end: it supports one end of the shuttle-box back, and one end of the spindle *n*. It is not shown in fig. 1, so that the picker and picking stick might be more distinctly seen. All the parts above enumerated are as usually constructed, with the exception of the upright shaft *f*, which is made rather shorter, so as to bring the picking stick



lower down; and the brackets  $f^1$ ,  $f^2$ , which are made rather longer, so as to throw the upright shaft rather farther from the loom side.  $p$ , is the picker, which is made with a slot in its upper part, as shown in fig. 2, for the end of the picking stick to come through, so that when the picking stick moves, it pushes the picker  $p$ , backwards or forwards along the spindle  $n$ . By this means the straps, bands, or chains usually employed to connect the picking stick to the picker are dispensed with.

The patentees claim, "connecting the picking stick (when it does not move with the lathe) to the picker without the intervention of the straps, bands, or chains usually employed."

*To WILLIAM HARRISON MORELAND and JOHN CHAPPELL, both of Loop Bridge Mill, near Belfast, for improvements in winding, warping, beaming, or dressing machines.*—[Dated 9th January, 1863.]

THE object of this invention is to secure an uniform tension of the yarn on the beam to which it is being transferred from spools or bobbins. The invention consists in the application to the ordinary winding, warping, beaming, or dressing machines that wind from the spools or bobbins of a drag roller or rollers for taking up the slack yarn caused by the over-running of the spools or bobbins from which the yarn is being wound.

The figure in Plate VII. is a transverse section of the improved winding machine.  $a$ ,  $a^1$ ,  $a^2$ , are the ordinary rollers of the machine, over and under which the yarn passes;  $a^1$ , being the measuring roller;  $b$ ,  $b^1$ ,  $b^2$ ,  $b^3$ ,  $b^4$ , are the falling rods, for taking up the slack yarn when backing off to find an end, &c.;  $c$ , is the beam whereon the yarn is wound;  $d$ , the roller that drives it by surface contact;  $e$ ,  $e^1$ , are the reeds or guides for the yarn;  $f$ , the framing of the machine. The drag roller  $g$ , rests upon the yarn, where it passes on to the roller  $a$ ; the direction of the yarn as it comes from the creel or bank which carries the spools or bobbins being shown by the lines  $h$ . This roller  $g$ , has a pivot at each end, which pivots pass severally through an eye fastened to a strap or other suitable material led over the carrier pulley  $i$ , and connected to a weighted balance lever  $k$ , supported by a stud  $k^1$ , fixed to the framing  $f$ . The pivots on the ends of the roller  $g$ , after passing through the eyes of the straps, enter guides  $g^1$ , which are fastened, one at each side of the framing  $f$ . The slot of these guides  $g^1$ , is continued below the centre of the roller  $a$ , to allow the roller  $g$ , to fall as the yarn is slackened.

The action of this roller  $g$ , is as follows:—When the machine is stopped, the spools or bobbins are liable to over-run, and thus leave the yarn slack until the winding re-commences, but the roller  $g$ , resting wholly or partially on the yarn, falls down the slot or guide  $g^1$ , as soon as the yarn begins to slacken by the stoppage or slackening of the winding, until it attains the dotted position  $g^2$ . To prevent the weight of this roller  $g$ , from continuing to take up the yarn at the first speed, it is caused to raise the lever  $k$ , from its vertical position, as shown, to a position approaching a horizontal one; thus gradually increasing the power of the weight  $k^2$ , until it, with the slight tension on the yarn, balances the roller  $g$ . By this means an uniform tension is secured to the yarn throughout the beam, and the action of the measuring roller  $a^1$ , is rendered certain.

The slack roller or rollers may be placed either before or behind the reed or first guide  $e^1$ , through which the yarn passes, and be supported either altogether, or in part only, by the yarn.

This improvement is applicable to all beaming, warping, or dressing machines that wind from the spool, whether for flax, cotton, or other yarns.

The patentees claim, "the means above described for taking up the slack yarn caused by the over-running of the spools or bobbins (from which the yarn is being wound) when the machine is stopped, or slackened, or in motion."

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TO JOHN WILLIAM PARKER FIELD, of High Holborn, for improvements in breech-loading fire-arms.—[Dated 31st December, 1862.]

THIS invention has for its object the diminution of metal in the joint piece of breech-loading fire-arms, so as to admit of its being inserted in the wood, and the gun being thereby made in the form of an ordinary "bar" or front-action lock gun. For this purpose, instead of employing a bolt with a circular motion, as usual, for closing the joint, a slotted bolt, with a rectilinear motion, is applied to the pivot of the lever, such bolt being projected into a notch, to close the joint by means of a cam or cams on the pivot of the lever.

In Plate VII., fig. 1 is a plan or horizontal view of the joint piece, showing the bolt out, or projected into the notch, for forming the joint; fig. 2 is a transverse section of a gun, showing the position of the joint piece in the wood; fig. 3 is a plan or horizontal view of the bolt, showing the cam and lever for working the same; and fig. 4 is a plan or horizontal view of the under side of the bolt. A, A, is the joint piece, which is inserted in the gun in the usual manner. This joint piece, on reference to figs. 1 and 2, will be seen to be formed with two sides, serving as fixed horizontal guides for the bolt B, which is thus capable of being moved horizontally, as required. This bolt has a slot formed in it, as shown in figs. 3 and 4, through which is passed a pin C, forming the pivot of the lever, on which is fixed a cam D, which, by the movement of the lever E, in a horizontal direction, is caused to act on the bolt B, and draw it out of the notch in the piece connected to the barrel or barrels, and allow the joint to be opened. F, F, (fig. 1) shows the parts of the joint piece, at which the barrel piece is hinged thereto. G, (fig. 2) is the wood in which the joint piece is inserted.

It will be evident, that by moving the lever E, into the position shown by the dotted lines in figs. 2 and 3, the cam D, will be turned in the direction of the arrow, and caused to press against the notch in the bolt B, which will thus be slidden between the fixed horizontal guides of the joint piece A, and removed from the notch connected to the barrel or barrels, so as to admit of the joint being opened when required.

The patentee claims, "the use of the slotted bolt with a rectilinear motion, worked by a lever in a horizontal direction, admitting of the diminution of metal in the joint piece, as represented and described."

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*To WILLIAM PHILIPPI, of Stromberg, Prussia, for improvements in the manufacture of bearings and axle boxes for machinery, carriages, and railway rolling stock.*—[Dated 3rd January, 1863.]

IN Plate VII., fig. 1 is a transverse section, and fig. 2 is a plan view, of a journal or bearing, prepared according to this invention. The bearing is hollowed out, as shown at *a, b, c, d*, to receive a compound prepared in the following manner:—Ten pounds of paper are cut up into small pieces and six pounds of linseed oil are added. When well combined, a mixture of three pounds of graphite and three pounds of gypsum is sprinkled thereon, and the whole is pressed into a homogeneous mass. So much of this material is placed in the hollow of the bearing as is necessary to fill the same under a pressure of three atmospheres.

In order to give it the proper form, an iron cylinder is used, having the form of the axle which is to work in the bearing. When the pressure is given, the bearing is kept for 24 hours in a temperature of about 150° Reaumur. Instead of the linseed oil, any other drying oil, glue, or gum may be used; and broken-up cotton, linen, hemp, or wood may be substituted for the paper; and instead of the graphite, talc, arsenic, or oxide of lead may be employed. These substitutes do not, however, produce such a good compound as that first described.

The patentee claims, "the application of the mixture to or in conjunction with the hollow spaces, constituting the improvements in the manufacture of bearings and axle boxes for machinery, carriages, and railway rolling stock, as herein specified."

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*To THOMAS AVELING, of Rochester, Kent, for improvements in the construction of traction engines.*—[Dated 7th January, 1863.]

THIS invention relates to the application to traction engines of certain improvements in their details of construction, with the view both of simplifying their construction and greatly enhancing their efficiency.

In order to change the relative speeds of the carrying wheels and the crank shaft according to the varying levels or the character of the ground over which the engine is travelling, the novel means shown in Plate VIII., is employed. Fig. 1 is a side elevation of so much of a traction engine as will serve to explain the nature of the improvements; the motion of the crank shaft being transmitted through an endless chain to the driven wheel. The carrying wheels *A*, are made broad, and cast with an annular rib in the middle of the periphery for running on hard ground, and with lateral projections for ensuring a firm bite of the ground. On the boss of the wheel *A*, is keyed the ordinary chain wheel *B*, round which the chain *C*, passes from a chain pinion *D*. This chain pinion is keyed on to a transverse shaft *E*, which is carried by brackets *F*, that serve also to carry the crank shaft *G*. By thus mounting these two shafts *E*, and *G*, on the same brackets, the use of additional fastenings, for securing the brackets to the boiler, are avoided; while at the same time, by the peculiar arrangement of the shafts, the distance between the chain pinion *D*, and the crank shaft *G*, is increased sufficiently to permit the use of a larger diameter of pinion than usual; which is a matter of considerable importance, as respects the maintenance of the gearing in efficient working

order. Keyed to the opposite ends of the counter shaft *E*, are spur wheels *H*, having different numbers of teeth to suit two different speeds of driving, and into these wheels gear spur pinions *I*, of varying diameter, on the crank shaft. These pinions are free to slide on feathers on their shaft, in order that either may be thrown into action at pleasure, according to the driving speed required. They are, by preference, shifted by hand, and kept in or out of gear, as the case may be, by the application of elastic clips, composed of a strip of thin steel lined with leather. The clips are made to clasp the shaft and retain their position thereon. But when the pinions require to be shifted, the clips are first taken off the shaft, and the pinions being shifted laterally by hand, the clips are again applied, but so as to bear against either side of the boss of the pinions. They will thus act like a fixed collar on the shaft, maintaining the pinions in the required lateral position.

To allow of the slack of the chain *c*, being taken up, the counter shaft bearings are set in segment slots in the brackets *F*, as shown best in the detached view, fig. 2. The segment slot is struck from the axis of the crank shaft *G*. The bearings of the counter shaft may be raised to any required height (within the limits of the slotted brackets), suitable for bringing the chain to tension, by the insertion of blocks *a, a*, below the bearings; and they are then to be held firmly by a binding screw *b*. From this explanation it will be understood that, when it is desired to reduce the speed transmitted to the driven wheel, in order that the engine may be enabled to ascend an incline, it will only be necessary to throw the small pinion *I*, into gear with its spur wheel *H*; the larger pinion being slid out of gear with its spur wheel. It will also be seen that, when the greatest stress is put on the gearing, the strain will be directly through the gearing, and thus the counter shaft *E*, will not suffer from torsion. When, however, the work is less severe, the motion will be transmitted through the larger pinion and its wheel, and thence through the shaft *E*, to the chain pinion *D*. In order to provide for a still further variation of speed, it is only necessary to change the pinion *D*, for one of less or more teeth, and two additional speeds will be thereby obtained.

The patentee claims, "the construction of the brackets *F*, as described, for carrying the crank shaft and counter shaft, and allowing of the latter being raised or lowered, to suit the length of the endless chain; and also, the mode of transmitting the power to the chain pinion from the crank shaft, by sliding pinions mounted on that shaft, and working into spur wheels on the axle of the chain pinion."

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*To CHARLES EDWARDS AMOS, of the Grove, Southwark, for improvements in machinery for the manufacture of paper.*—[Dated 13th January, 1863.]

THIS invention relates to that part of paper-making machinery in which the knots, lumps, pieces of stick, dirt, and other impurities or extraneous matters are removed or separated from the fine pulp of which the paper is intended to be made. The invention is more particularly applicable to the knotters through which the pulp flows in an upward direction, leaving the extraneous matters below the straining or knoter plates. A portion of the invention is also useful when applied to vats provided with

knotters through which the pulp passes from the outer to the inner side of the knotters, and in which the knots and other extraneous matters have hitherto been left in the vats.

In Plate VIII., fig. 1 is a partial plan view of the machine for manufacturing paper, and fig. 2 is a sectional elevation of the same. *A*, is a knotter of a similar construction to the knotter patented by Amos and Clark in 1849; the driving motion of the moving parts being applied in a like manner. The pulp is, however, supplied to and taken away from the knotter in a different manner to that described in the patent above referred to. The unstrained pulp is raised by the ordinary lifter into the horizontal trough or shoot *B*, from whence it passes through the ports *a, a*, to the space beneath the knotter plates *b*, or straining surface. Through these plates the pulp passes in an upward direction, and is cleansed thereby from the extraneous matters which are mixed therewith, and runs off by the spout *b*, to the paper-making machine; the knots and impurities, with some thickened pulp, remaining beneath the plates. After the knotter has been working some time, the knots and impurities would accumulate beneath and choke the plates, and the machine would have to be stopped and the knotter cleansed; but to prevent this an outlet pipe *c*, is adapted to the space below the knotter plates, for the purpose of allowing the knots and other impurities to pass into a "stuff pump" *d*, of the ordinary construction, or any other suitable lifter which will force or lift them into another and ordinary knotter *c*; where the knots, impurities, and refuse are left on the top of the plates, and can be removed at intervals by a "slice" or "skimmer." The useful pulp that had previously mixed with the knots passes downward through the plates of this second knotter, and is conveyed by a pipe *e*, to a receiving vat *f*, and from thence through the pipe *g*, into the first or ordinary lifter; where, meeting and mixing with fresh pulp, it will be supplied again to the trough or shoot *B*, and will pass from thence down the passages *a*, to the space beneath the plates of the first knotter *A*. The straining process is in this manner continued uninterruptedly, so long as the machine is required to be worked; a regulated portion of the foul or thick pulp being drawn off continuously from beneath the knotter plates of the knotter *A*, and supplied to the second knotter *c*, from which the extraneous matters can be removed without stopping the machinery.

The advantages of the invention will be duly appreciated when it is understood that in cases where cylindrical, polygonal, or other constructions of knotters are placed in a vat, from which vat the pulp passes through the plates of the knotter, the knots and impurities are left in the vats, and, by continuous working, these knots and extraneous matters accumulate to such an extent that the flow of the pulp to the paper-making machine becomes irregular, and at length the machine has to be stopped, and the vat cleansed from knots and impurities. It will be evident, therefore, that any such stoppage will be unnecessary if a small but uniform portion of the knots, impurities, and thickened pulp be regularly and continually removed from the vat by any ordinary "stuff pump" or other lifter; and by causing this abstracted portion to pass through an entirely distinct ordinary knotter, the knots and impurities will be separated and left upon the plates, and can be removed therefrom by the "skimmer," without affecting the flow of pulp to the paper-making machine. The useful pulp which was previously mixed with the

knots and impurities will pass through the knotter plates, and may be conveyed from thence to the ordinary lifter, where it will be mixed with fresh pulp, and the straining process continued.

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*To THOMAS CRITCHLEY BARRACLOUGH, of Manchester, for improvements in apparatus for cutting metallic tubes or pipes, or tubes or pipes composed of other indurate substances,—being a communication.—[Dated 15th January, 1863.]*

THE improved apparatus, for cutting or dis severing pipes or tubes, consists of two metallic jaws, by preference made of malleable or other elastic description of cast iron or steel, and hinged together at one extremity, and so formed near the hinge or joint as to receive the pipe to be cut at right angles to the cutter employed: to these jaws, at the further end to the hinge, two steel or wrought-iron rods are attached. The cutter, which is made of steel, slides vertically through one of the jaws, and its cutting force or pressure may be adjusted by means of a thumb screw above it. The pipe to be cut is placed in the hollow made for its reception; the two opposite ends of the rods are then brought nearly together and secured by a link—the jaws being thus caused to hold the pipe—and the cutter is tightened thereupon. If, now, the pipe be held firmly in a vice, and the apparatus turned several times round in a direction at right angles to the axis of the pipe, the cutter will penetrate the material and sever the tube. If the metal or substance of which the tube is made be very thick, more pressure is to be applied gradually to the cutter, by means of the screw, until it is cut through.

The figure in Plate VIII. represents a side view (shown partly in section) of the apparatus for cutting tubes, in which *a, a*, are the jaws, hinged together at *c*, and to which are attached the rods *b, b*. These rods are retained in the position shown by means of the link *d*. The steel cutter *e*, slides in a slot in the upper jaw, and may be tightened to any required pressure by means of the screw *f*, so as to cause the cutting points to enter the tube *g*, which is held in a vice, or otherwise fixed whilst the apparatus is turned round. By the continued turning and pressing in of the cutter, one portion of the tube will be severed from the other, as described.

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*To THOMAS CRITCHLEY BARRACLOUGH, of Manchester, for an improved alarum apparatus, which may be employed in connection with locks or other fastenings,—being a communication.—[Dated 15th January, 1863.]*

THIS invention consists, first, in a novel arrangement of bell alarum,—the bell being struck by a hammer connected by mechanism with the latch and handle, when opening or closing doors (drawers, tills), or other such means of enclosure or security, in conjunction with a disengaging gear. Secondly, in the application of the alarum with locks or other similar fastenings, and in an arrangement of apparatus whereby the alarum may be disconnected from the lock when its use is not required.

In Plate VIII., fig. 1 is a plan view, representing an alarum apparatus,

combined with a door lock or fastening, and acting in connection with the lock,—the dotted lines showing the position of the parts when disconnected from the lock and no alarm effected; the covering plate being removed to exhibit the internal construction. Fig. 2 illustrates the application of the alarm apparatus to a drawer or till.

In fig. 1, *a*, is the latch or door fastening, which may be withdrawn by means of the hand lever *b*, or by means of a key, whereby the spring *a'*, is compressed, and the latch or bolt released. By this action, the sliding piece *c*, and plate *c'*, hinged thereto, are also drawn back: the projection on the hinged plate *c'*, being pressed by the spring *d*, is thus brought into contact with the hammer tail piece *e*; thereby lifting the hammer, which, on its descent, is caused to strike the bell by means of the spring *g*. When the bell is not required to ring, it may be disconnected from the latch by turning the ward or finger *h*, upwards; thereby raising the hinged plate *c'*, as shown in dotted lines, so as to keep it out of contact with the hammer tail piece, and thus the lock may be used without giving alarm, if required.

In adapting the invention to drawers or tills, when no key is used, the end of the latch is formed, as shown in fig. 2, so that in opening the drawer it will become depressed by the fixed projection *i*, on the drawer framing, and thus give alarm; or it may be applied, as in fig. 1, to act with a key or handle.

The patentee claims, "the novel construction and arrangement of mechanism for effecting a self-acting alarm, which may be disengaged and made not to ring, in connection with locks or fastenings for doors, drawers, tills, or other means of enclosure or security; and the adaptation of an arrangement of mechanism for disconnecting the alarm from the lock or fastening when required, as described."

*To ANTHONY DUGDALE, of Paris, for improvements in throttle valves.—*  
[Dated 21st February, 1863.]

THIS invention relates to an improved mode of mounting and actuating throttle valves. As now practised, the throttle valve is worked direct from the governor, a rod from which is connected to a lever or arm on the spindle of the throttle valve. This arrangement is open to objection, inasmuch as it causes the spindle to wear loose in its bearings, in consequence of the continual friction to which it is subjected.

In order to remedy this, the improved valve is arranged in such manner that the pin upon which it is mounted or turns shall be entirely independent of the actuating parts, and shall serve merely as a pivot for the valve to turn upon; the parts for transmitting the movement of the regulator being connected to one extremity of the body of the valve, instead of to the valve shaft.

In Plate VIII., figs. 1 and 2 are longitudinal sections, taken through the middle of the steam pipe, provided with its throttle or regulating valve, which is shown in the position in which it would be in order to completely close the steam pipe. Fig. 3 is an exterior view of the steam pipe, showing the parts for actuating the valve. The body *a*, of the valve turns upon a pin *b*, passing through its centre. It is actuated by means of a link *c*, connected to a forked arm *d*, mounted upon the shaft *e*.

Upon this shaft, but outside the pipe, is a lever *f*, hinged at *i*, to the actuating rod *g*. The lever *f*, is provided with a moveable weight *h*, for acting upon the valve. In this arrangement, the pin *b*, being placed in the middle of the thickness, and in the line of the smallest diameter of the body *a*, of the valve, must necessarily, in all positions, be subjected to about the same pressure, and allow the plate to turn freely as upon a hinge or two pivots.

The patentee remarks, that instead of the connecting rod or link *c*, and arm *d*, for transmitting the movement of the shaft *e*, to the valve, toothed sectors, or other equivalent mechanical arrangements, may be employed.

The patentee claims, "mounting and causing the valve to turn upon a shaft, independent of the actuating parts, these latter being connected, inside the steam pipe, by jointed rods, toothed sectors, or other mechanical equivalents, connected to one extremity of the body of the valve, so that the shaft shall serve merely as a hinge or pivot for the valve."

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To WILLIAM EDWARD NEWTON, of 66 Chancery-lane, for improvements in producing stereotype plates for printing purposes,—being a communication.—[Dated 25th February, 1863.]

THIS invention relates to certain means for producing curved stereotype plates. The matrix is made on a sheet of steel or other elastic substance, the normal shape of which is curved. But in order either to cast the stereotype plate or to form the printing surface by electro-deposition, the curved plate must be made to assume a flat or straight form, by being secured, in any convenient manner, to a flat plate or table. The clay, wax, or other suitable plastic material to form the matrix, is then put on the plate, and the impression is taken therein. The elastic plate is then released, when it assumes its original curved form, imparting the same to the matrix. The matrix is then dried, and the stereotype plate is cast or formed by electro-deposition.

In Plate VII., fig. 1 represents the elastic or steel plate *a*, in its normal or curved form. The plate is provided with dovetailed end bars *a*<sup>1</sup>, *a*<sup>1</sup>, whereby it is held down when required. Fig. 2 is a partial side view of the table *b*, on which the plate *a*, is to be laid out flat, to receive the wax or other plastic material to form the matrix. When the plate *a*, is to be laid out flat for this purpose, one of the dovetailed end pieces *a*<sup>1</sup>, is to be passed under the fixed clamp *c*, which is secured to the table *b*, for the purpose. The other dovetailed end piece *a*<sup>1</sup>, is embraced by the screw clamp *c*<sup>1</sup>, and by tightening up this latter, by means of the thumb-screw *d*, the plate *a*, will be drawn perfectly flat and level, ready to receive the plastic material. When the matrix is formed, the plate *a*, is to be released; and when the plate *a*, with the matrix thereon, is removed from the table, it will assume its normal or curved form, as shown in fig. 1. The electro-depositing process, or other operation for producing the printing surface, is then proceeded with in the well-known manner, and a curved stereotype plate is produced, as above mentioned.

The patentee claims, "the use of the elastic plate *a*, or its equivalent, for holding the plastic material for forming the matrix or mould, as herein set forth."

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To WILLIAM EDWARD NEWTON, of Chancery-lane, for improvements in the application of power designed for stationary and traction engines, propellers, and other machinery,—being a communication.—[Dated 12th January, 1863.]

THIS invention relates to the employment of a system of dogs or driving catches, for operating upon the interior of the rim of a wheel, for the purpose of producing its rotary motion. These dogs or driving catches are arranged in two sets, and are applied in connection with a lever or levers arranged to oscillate upon the shaft of the wheel or pulley, so that in the movement of each of the levers in one direction, the dogs will work free of the rim, and in its movement in the opposite direction they will bite the rim, and thereby transmit a rotary motion to the wheel and to its shaft.

This part of the invention consists in certain devices employed in connection with this double system of dogs, to provide for the reversal of the rotary motion at pleasure.

The invention further relates to a certain means employed for varying the application of the driving power, whereby, when required, speed may be decreased, and a proportionate increase of power obtained; and the utmost capacity, as regards speed, obtained when desired; and a steam-engine rendered capable of being used as either a traction or stationary engine, as may be required.

In Plate VII., fig. 1 is a side view of the invention, adapted for transmitting motion from the piston rod of a steam-engine to the shaft thereof, or to the axle of a locomotive; fig. 2 is a top view of the mechanism connected with the shaft or axle, and is shown partly in section; and figs. 3 and 4 are detached views of parts which are connected with the piston rod, for the purpose of regulating the application of the power of the engine to the parts to be driven.

A, is the connecting rod, through which motion is to be transmitted from the piston rod of the engine to the shaft B; C, is a wheel fast upon the shaft B, and having a projecting rim *a*, on each side, for the dogs to act upon; D, D', are two levers, which are fitted to oscillate upon the shaft B, one on each side of the wheel, and extending nearly across the wheel inside of the rim. Each lever carries two dogs *b*, *b*<sup>1</sup>,—one on one limb of the lever and one on the other, constituting one system, and operating to drive the wheel C, in one direction; and the other two constituting another system for driving the wheel in the other direction. These dogs are severally pivotted to their respective levers by pins *c*, *c*, and may be arranged to fall back toward the levers by gravitation, or they may have springs applied in connection with them, to throw them back. The falling back of the dogs toward the levers brings their points in contact with the inside of the rim of the wheel; so that when the lever is turned in either direction, the dog which is in front according to that direction, and in contact with the rim *a*, is caused to bite the rim and make the wheel turn; and when the lever is turned in the opposite direction, the friction of the dog on the rim will free it. The dog *b*, is represented in fig. 1 in the first-mentioned condition, the lever moving in the direction of the arrow shown in that figure, and the dog *b*, turning the wheel in that direction. The oscillating motion of the two levers D, D', is obtained from a rocking shaft E, arranged parallel with the shaft or axle B. The

rocking shaft has two opposite arms  $d, d^1$ , which are connected by rods  $e, e^1$ , one with each of the two levers  $D, D^1$ . The connecting rod  $A$ , is connected with one arm of the rocking shaft  $E$ , and produces the rocking motion thereof by which the rods  $e, e^1$ , are caused to produce such an oscillating movement of the levers that one always moves in the reverse direction to the other. The object of the reverse movement of the two levers is, that each may carry back one of the dogs of one system, while the other brings the other dog of the same system into operation; and, hence, the two keep up a continued rotary movement of the wheel. The two dogs on each lever are, of course, not allowed to come in contact with the rim at once, and hence each lever has attached to it a spring  $f$ , for the purpose of holding one dog out of contact. The dog  $b^1$ , is the one represented in fig. 1 as being held out of contact and in operation, and is connected with the spring by a cord or chain  $g$ . The other dog  $b$ , which is the dog for moving the wheel ahead (*i.e.*, in the direction of the arrow shown in fig. 1.), is also connected with the spring by the cord or chain; but the portion between that dog and the spring is slack, in the normal condition of the spring, and does not interfere with the dog. The portion of the cord or chain  $g$ , between the spring  $f$ , and the other dog  $b^1$ , is connected with a crank  $i$ , on one end of a small pin  $k$ , which is fitted into a suitable bearing in the lever; and at the other end of the pin  $k$ , there is another crank  $l$ , which protrudes through a slot in the hub of the lever, on the side farthest from the wheel. The shaft  $B$ , is fitted on the outer side of the lever, with a sliding collar  $r$ , which, when it is desired to reverse the rotary motion of the wheel and shaft, is slidden along the shaft toward the lever, and caused to act upon the small crank  $l$ , in such a manner as to turn the pin  $k$ , in such a direction that the other small crank  $i$ , will draw upon the portion of the cord or chain  $g$ , between it and the dog  $b$ , thereby overcoming the tension of the spring  $f$ , and drawing the dog  $b$ , out of contact with the rim  $a$ ; at the same time slackening the portion of the chain between it and the other dog  $b^1$ , and allowing the latter to come into operation for turning the wheel and shaft in the opposite direction to the arrow. When the sliding collar  $r$ , is moved back, away from the crank  $l$ , the spring  $f$ , draws the dog  $b^1$ , out of gear, and lets the dog  $b$ , drop into gear again. The crank pins  $k$ , belonging to both levers, should be connected in such a manner that both may operate simultaneously on the dogs of the two levers, so as to bring one system out and the other system into operation. By these means of reversing the action of the dogs, the direction of the rotation of the wheel  $c$ , and shaft, can be changed at pleasure, without stopping the engine. The double system of dogs and reversing apparatus can be applied in connection with the driving wheels of a locomotive; one of the rocking levers  $D, D^1$ , being applied to one driver, and the other to the other driver; and in this way the locomotive can be driven by a single engine, without any dead points.

In apparatus for transmitting a reversible intermittent rotary motion, a single lever and two dogs only are necessary. The connecting rod  $A$ , at its end opposite to the one which is connected to the arm  $d^1$ , is fitted on journals  $a^*$ , on a slide  $c$ , the latter being on a rod  $H$ , the upper end of which is attached to a semicircular bar  $I$ , at the centre of its concave side, as shown in fig. 3. This semicircular bar  $I$ , is provided at its ends with journals  $b^*$ ,  $b^*$ , which work in bearings, attached to any suitable fixture;

and on the upper convex side of the bar *I*, there are two upright arms *c\**, *c\**, in which are fitted the journals of a shaft *J*, which has a pinion *d\**, upon it, and a crank *e\**, at one end. The pinion *d\**, gears into a rack *K*, which is fitted in a guide *e\*\**, just behind, and attached to the upright arms *c\**, *c\**; the lower end of the rack being connected to the slide *G*. The lower end of the rod *H*, is attached by a pivot or joint *f\**, to the piston rod *L*, of the steam cylinder *M*, and motion is communicated to the connecting rod *A*, from the piston rod *L*, through the medium of the rod *H*; the latter oscillating from the journals *b\**, *b\**, of the semicircular bar *I*. The stroke of the piston rod *L*, is, of course, constant, as is also the oscillation of the rod *H*; but the length of movement of the connecting rod *A*, may be varied at pleasure, by raising and lowering the slide *G*, on the rod *H*, which is done by turning the shaft *J*, and by the pinion *d\**, raising or lowering the rack *K*. The rack, and consequently the slide *G*, may be retained at any desired point, by means of a pawl engaging with the pinion *d\**; or any other suitable means may be employed for such purpose. The connecting rod *A*, may, by raising the slide *G*, to a point in line with the journals *b\**, *b\**, be deprived of any motion whatever, and the wheel and shaft *B*, would, in this case, be inoperative, and the engine could be used as a stationary one, or be employed for driving any machinery temporarily, as is frequently required of locomotives—such, for instance, as the pumping of water to supply the tanks on the tender. In cases also where an increase of power is desired, that end may be attained by raising the slide *G*; thereby increasing the leverage of the rod *H*. The speed, in this case, is diminished proportionally to the increase of power. This variation in the application of the power of the engine is applicable to any propelling mechanism: the rods *e*, *e'*, for instance, may act directly upon the earth, so as to shove the locomotive along—one rod acting upon or against the earth, while the other rod is being drawn back for a following or succeeding shoving operation.

The patentee claims, "First,—the employment, in combination with each other and with the dogs *b*, *b'*, and their carrying lever, of a pin *k*, with cranks *i*, *l*, a spring *f*, and a cord or chain *g*, for the purpose set forth. Secondly,—the connecting of the rod *A*, to a slide *G*, fitted on a rod *H*, which is attached to the piston rod *L*; the slide being also provided with a rack *K*, into which a pinion *d\**, gears, for the purpose specified."

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To CHARLES FAULKNER and DAVID FAULKNER, of Birmingham, JAMES FAIRLEY, also of Birmingham, and WILLIAM CHARLES STIFF, of Edgbaston, for improvements in the manufacture of gun barrels.—  
[Dated 4th February, 1863.]

THESE improvements in the manufacture of gun barrels consist in welding "moulds" (made in the ordinary way, and of any suitable quality of iron) at the joint or meeting of the metal, by heating them to a welding heat in a suitable furnace, and passing them through a pair of grooved rods; which has the effect of welding, and also partially elongating them. In this state, the tube, or partially-formed gun barrel, is converted from the condition of iron to that of steel, by the ordinary process; and when thus converted, the operation of rolling or elongating the tube to the

desired length is completed by the ordinary process; internal as well as external pressure being by preference used.

Instead of commencing with a mould, as before described, the patentees also propose to take one formed of cast or any other kind of steel, and, before performing the operation of welding, to put the mould through the ordinary process of decarbonizing, in order that the process of welding may be thoroughly effected. After the welding and partial elongation has been performed, it is again restored to its former condition by re-carbonizing, and then the tube or barrel is completely elongated or finished; but by preference that portion of the barrel intended for the breech end is protected from undergoing the process of conversion or carbonizing, whether the barrel be formed from an iron or steel mould.

The patentees claim, "converting or carbonizing partially-formed tubes of iron or steel for gun barrels, technically called "moulds," whether the same be formed by coiling, welding, drilling, punching, or casting, and then elongating or finishing the same in the ordinary way, as now commonly pursued."

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*To CHARLES SMITHIES and GEORGE LANCELOT SMITHIES, both of Manchester, for certain improvements in preparing and bleaching "rhea" and other fibrous materials and fibres; which improvements are also applicable to bleaching yarns or piece goods.*—[Dated 3rd February, 1863.]

THE fibres or fibrous materials, after having been properly cleansed and opened by scutching machinery, are placed in trays, made of galvanized iron wire, and provided with handles, to facilitate their being moved about and raised from or lowered into cisterns or vats, by cranes or other suitable appliances. These trays, with their contents, are immersed in cold soft water, contained in vats or cisterns, having removable grids at the bottom, to admit of the separation of any deposit or sedimentary matter, and the fibre is allowed to soak therein for about twenty-four hours; at the end of which time the water is to be withdrawn. The cisterns or vats are then refilled with clean soft water, which, with the fibrous materials or fibres, is maintained at a temperature of from 90° to 100° Fahr., for twenty-four hours, by passing steam into the cisterns, by means of any convenient apparatus connected therewith. The fibrous materials are then removed, and passed between fluted rollers, under a suitable pressure, to express the water and various impurities dissolved by the foregoing treatment, and also to break and soften the fibre, and are then treated with vegetable, animal, or mineral oils, if necessary, and replaced in trays, provided with divisions for keeping the fibres straight and preventing matting. These trays are then placed in an air-tight chamber, having a removable grid, or false top and bottom. The air is exhausted by any ordinary means from the chamber, and the bleaching liquor, which consists of a solution of caustic soda or other caustic alkali, is admitted at the bottom, and forced up through the fibrous materials until the chamber is filled: the materials are to remain thus saturated for about twelve hours, at a temperature of 120° to 212° Fahr. The air is then to

be admitted into the chamber, and the waste liquor drawn off; when the fibrous materials are subjected to the action of a solution of soap and soda, or caustic soda, or other alkali, until the coloring matter has been removed. The soap and alkali may be applied either by forcing into the chamber a solution of these ingredients, or they may be conveyed into the fibrous materials by means of steam; in which latter case, either steam raised from a solution of soap and alkali or caustic alkali, is passed through the materials, or steam, generated in the ordinary way, is passed through a strong solution of soap and alkali or caustic alkali, contained in a separate vessel, before coming in contact with the fibrous materials; which latter become thereby impregnated with these ingredients. When the coloring matter has disappeared, the alkaline and saponaceous matters are removed by the admission of cold soft water into the vat or chamber; and after that, steam is passed through the material until it is perfectly white, lustrous, open, and nearly dry. In bleaching yarns and piece goods, plain instead of grooved or fluted rollers are used to extract the water and dirty matter, and in bleaching piece goods, the trays are dispensed with.

The patentees claim, "the combination and arrangement of the various processes, and the apparatus and appliances to be used therein, in the manner and for the purpose set forth."

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*To JAMES ALEXANDER MANNING, of the Inner Temple, for improvements in the treatment of night soil and other waste products, and for the manufacture of manure therefrom.*—[Dated 4th February, 1863.]

THE mode adopted by the patentee for rendering permanently useful to agriculture all the human excreta collected in towns and other localities where no sewers exist, or where, as in some towns, they have been constructed merely for surface drainage, is as follows:—In the first place, it is necessary, for the proper application of the process, that the cess-pits shall be thoroughly lined with cement, so that neither the rainfalls nor ordinary drainage may enter therein, to dilute their contents. A wall of division is erected in the privies or ash pits where coal ashes and household wastes are discharged into them, so as to separate the dry wastes in question from the excrementitious matters. These two necessary arrangements being made, the patentee applies to the bottom of the empty privy or cess pit a quantity of sulphuric acid, not exceeding the proportion of 40 lbs. of sulphuric acid to one ton of mixed solid and fluid excreta to be combined therewith; such acid to be of the ordinary commercial strength, or diluted with three or four times its volume of urine. This acid is added for the purpose of converting all the ammoniacal salts contained in the solid and fluid excreta thereafter discharged into the privy or cess-pit, from time to time, into sulphate of ammonia, and effectually preventing the evaporation which has hitherto occurred, owing to the fermenting power or action of the urine in its decomposition; which converts the different salts into carbonate of ammonia, the most volatile of all the salts of ammonia, and by which upwards of 50 per cent. of ammonia is evolved, and passes away into the atmosphere, to the pollution thereof, a great loss to agriculture, and the detriment of the public health.

In place of sulphuric acid there may be used carbonized or dry seaweed, and especially the species known as the "*Fucus nodosus*," dissolved in sulphuric acid, as also waste kelp, and reduced to a pulverulent state, nearly resembling superphosphate of lime, which is also employed at times instead of the foregoing preparations. This is sprinkled at the bottoms of the privies or cess-pits, and subsequently, at the proper times, when about half a ton of the excreta is collected therein, upon the surface of the excreta, by which the per-centage of the mineral constituents of the manure, indispensable to the organism and development of plants, is increased, and deodorizing properties of the acid is enhanced by the vegetable charcoal combined therewith.

When the cess-pits or privies are emptied, the matter removed is carted to the works, and discharged into a tank or tanks of sufficient dimensions to hold one or more days' product of any town to which the process may be applied; and it is there agitated by steam or horse power, so as to amalgamate the whole, and reduce it to a liquid or semi-fluid state, when it is passed from the lower extremity of the tank through covered shoots or troughs, at a proper inclination, and charges a series or set of cast-iron retorts by its own specific gravity on its passage.

These retorts are heated by coal from three furnaces—one situate at each side of, and the third in the centre, under the front of the retort, the lower half of which opens for the discharge of the product when the operation is completed. In their form the retorts are a very flat oval, in order to obtain the largest possible surface for the evaporation of the fluid portion of the excreta; the whole mass being kept in a continuous state of agitation as soon as it reaches the boiling point until the operation is completed, by an agitator, which works backwards and forwards from the centre to each side, to prevent the adhesion of the solid matter to the bottom of the retort. The retorts are only charged with the mixed fluid and solid excreta to half their capacity, in order to facilitate the rising of the vapour at or over their widest surface. To ensure a more rapid evaporation, a strong current of heated air is introduced over the surface of the boiling mass, to drive off the vapour. When the fluid is evaporated, and the solid matter is brought nearly to a state of dryness, the lower half of the front of the retorts is unscrewed, the solid product is discharged into iron waggons, and conveyed on a tram road to drying and sifting houses, where it is prepared for the market.

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*To JOHN CAMERON, of the Hematite Iron Works, Barrow-in-Furness, Lancashire, for improvements in the manufacture of iron and alloys of iron.*—[Dated 7th February, 1863.]

IN manufacturing iron according to this invention, the patentee, in the first place, ascertains the nature or quality of the ore or ores of iron to be operated on, and proceeds by chemical analysis to estimate the quantity of each constituent of the ore or ores, and in particular to ascertain the amount of sulphur which may be present, as this element is well known to be a deleterious substance in the iron manufacture when it is present in any considerable amount. If found to be present in any considerable amount, calcination or roasting is resorted to as a preliminary

operation, in order to oxidize the metal and eliminate the sulphur in the form of sulphurous acid. Having ascertained the quantity of oxygen in the ore, one equivalent of carbon—in the form, by preference, of coal, coke, or charcoal—is added. One equivalent of flux is also added for every equivalent of silica present in the ore, lime being used by preference, but other flux used by iron smelters may be substituted therefor. At the same time a sufficient quantity of the flux is added, to take up any siliceous matters that may be present in the fuel employed for the reduction of the ore. If the fuel contains any sulphur, which is frequently the case, there is added to the mass of mixed materials a little more lime or other flux, to neutralize the sulphur by combining with it, so as to form a sulphuret of the metallic base of the flux that will pass away in the cinder, or in a gaseous form, during the process. The materials being properly proportioned, are mixed thoroughly by grinding, with the addition of water, so as to bring all the parts intimately together, in order that the re-action of one substance on another may be complete when subjected to the smelting process. The mixture, being reduced to a pasty mass, may be cast into blocks. These are partially dried before being put into the furnace for the final operation; the more completely the drying is effected, the better. The blocks thus prepared are taken to a cupola, reverberatory, or blast furnace, and subjected to heat till the metal is reduced. If the operation is carried on in a blast furnace or cupola, a sufficient proportion of fuel to obtain a brisk combustion is employed in the usual way, besides what is in the blocks. If the operation is carried on in a reverberatory furnace, fuel is employed in the grate to heat up the hearth of the furnace where the blocks are smelted, the blocks at the same time containing their portion of fuel.

To make an alloy of iron and some other metal, there is added to the mixed materials being formed into blocks the oxide or compound of the other metal which it is wished to alloy with the iron, and at the same time as much flux and carbon additional as will facilitate its perfect reduction, so that it may combine with the iron to form an alloy. Thus, when making an alloy of iron and other metal, it is not required to reduce the separate metals to the metallic state first, and then melt them together; this is obviated by the simultaneous reduction of the oxides or compounds of both metals, thus economizing fuel and labour.

The patentee claims, "the manufacture of iron as above described, by mixing with the iron ore the quantity of fuel and flux necessary for its proper reduction, grinding and intimately mixing these materials, and forming them into blocks, which are then smelted. Also the production of alloys of iron by the employment of ores of two or more metals in the making of the blocks, the process being otherwise similar to that above claimed for the manufacture of iron."

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## Scientific Notices.

## INSTITUTION OF MECHANICAL ENGINEERS.

*(Continued from page 179.)*

The next paper read was, "*On the construction and application of iron armour for ships of war,*" by Mr. NORMAN S. RUSSELL, of London.

THE problem of forming an iron fleet would, at first sight, seem a simple matter; for starting with the following facts, proved by experiment,—first, that 1-inch thickness of iron breaks up shells, so as to prevent their explosion as shells; secondly, that  $2\frac{1}{2}$  inches thickness of iron stops them completely, and prevents the fragments of the broken shell from being carried through the ship's side like grape; and, thirdly, that  $4\frac{1}{2}$  inches thickness stops the heaviest shot, fired from the most powerful guns, which the science and manufacturing skill of this country have hitherto produced—it is only necessary that the vessels of the present wooden fleet, as they already exist with engines on board, should be coated with the heaviest of these three thicknesses of iron, which each ship is able to carry, and an iron-plated fleet will then be obtained. It is true, that this immense fleet will cost more than a new and effective one of equal power; that not one of these vessels would be able to cross the Atlantic; that the entire fleet could not prevent a single fast cruiser from seizing all the gold ships on their way from Australia; and that they could not effectively blockade the coast of any foreign power with whom there might be war: our supremacy at sea would be gone, but we should be safe from invasion, and able to stop an enemy attempting to land here.

This problem has already been tested, with regard to the iron-coated French and English batteries. Several of them were built by this country, and sent on their way to the Crimea; but after several disasters, and going as fast as they could under steam and sail, they got only half way, and returned to this country, having done nothing: in short, they were not sea boats. Such an iron-plated wooden fleet would be of little more value than local batteries on shore, but only a very little; they could shift their position, it is true, and, provided it was known where an enemy intended to land, they could prevent his landing; but their advantage, in this respect, over land batteries would hardly compensate for their superior cost.

To retain our supremacy at sea, a fleet must be formed that can not only fight a battle, but also ensure winning it. Such a fleet must be designed and constructed anew from the beginning; whether it shall be constructed entirely of iron or with wood backing, to support the armour plates, is still an open question; but, in order to possess all the good qualities which are required in naval warfare, there can be no doubt that the structure of the vessels must be of iron. The real difficulty of the problem consists in this, that any existing ship of war, when iron-coated, will be slow, unseaworthy, and combustible, and will be incapable of long voyages; whereas, the fleet of England must be



able to keep at sea for a long time, to steam long distances, to go faster than the ships of any other country, and to be in better condition than other fighting vessels in all weather, especially the worst. The whole difficulty consists in designing vessels possessing all these qualities in addition to being shot proof.

To begin the consideration of an iron shot-proof fleet, by taking an example of a vessel which it would be wished to construct, if possible,—the question arises, can shot-proof gun boats, such as have hitherto been built, be now built 140 feet long, 24 feet beam, of 80 horse power, and carrying 4 guns; and the answer is, they cannot be built, because the weight of iron would sink them. Even an iron-plated corvette, of a favorite class, 190 feet long, 86 feet beam, and drawing 16 feet of water, propelled by 250 horse-power engines, could not be constructed. In short, to carry a high side out of the water, the ship cannot be much less than 60 feet beam, and to go with the requisite speed it must have a length of about 400 feet; it would then be a completely shot-proof iron ship, worthy of the British fleet; but even this vessel would be 7000 tons burden. Smaller vessels can, of course, be built, but if they are to have good qualities, and are intended to act in concert with the more powerful vessels, they must be only partially coated, and will be compromises.

The first ship of this class will be like the "Warrior;" the next will be a smaller vessel, with only the engines, boilers, and magazine protected; and the last will be a small, shallow-water gun boat, with one gun protected by a shield in front. But as far as a sea-going fleet is concerned, the engines, boilers, and magazine must be protected; and it is this indispensable requirement which makes an effective ship of war really a very large one. It seems to be agreed that 14 knots an hour is the minimum speed of fighting vessels of war for the future; but this speed cannot be got in a vessel under 200 feet long, and for that purpose the lines must be very fine. In order to carry the engines and boilers, which must be protected, the ship must be 60 feet longer; and in order to carry also a coated battery of 10 guns, it will have to be 40 feet beam; and even then the vessel is only partially coated.

It will thus be seen, that the large size of vessels which are to be entirely coated, and the mere partial coating of smaller vessels, are equally inevitable. Both are the results of unalterable laws, in the adoption of which there is no choice. This point has to be insisted upon the more strongly, because the question has sometimes been considered as if both the size of vessels, and the extent and nature of their armour, were matters of free choice.

The consideration of armour resolves itself into three principal question:—first, what is the best kind of armour merely to resist the impact of shot; for which purpose, the armour may be considered to be simply hung on the side of the ship, in no way contributing to the strength of the structure, but merely as dead weight hanging on the hull. Secondly, what is the best way of forming the structure of a ship entirely of iron, with a view of employing the whole strength of the iron for the purpose of rendering the structure of the ship as strong as possible; making the vessel only so far shot-proof as the nature of the structure will admit, and considering resistance to shot a secondary object. In the first of these methods, armour plates are hung on an already finished

ship; in the second, a ship is built up of thin plates, in such a way, that these plates may afford as much protection as their weight can give. It remains to be considered, however, thirdly, whether the thick armour plates and the thin ship plates could not be so combined together, in the structure of a ship, as to give that ship all the benefit of them both as armour plates and as integral parts of the strength of the ship.

The first of these questions is easily disposed of. In the original floating batteries of 1854, an ordinary wooden hull of a ship was covered with iron plates, weighing about 3 tons each and 4 inches thick, tacked on by through bolts of  $1\frac{1}{2}$  inch diameter, slightly coned and counter-sunk on the outside, with nuts on the inside, perforating, of course, the sides of the vessel. It is in this simple and rude manner that the six vessels, now building by the Admiralty, are coated over with  $4\frac{1}{2}$  and  $5\frac{1}{2}$  inch armour plates. The armour of the French wooden vessels is also fixed in this manner, except that wood screws have been substituted for through bolts and nuts.

The "Warrior," the first English armour-plated ship, is coated on this principle, which is not affected by the circumstance of this vessel having an iron skin.

The first reliable experiments made in this country on armour plates, were those against the side of the "Trusty," in 1859, of which Admiral Halstead has left a valuable record. The armour consisted of 4-inch iron plates, fastened to the side of the vessel, which was equal in scantling to that of a 90-gun ship. The general result of these experiments was, that out of more than 25 shots, fired from Armstrong, Whitworth, and ordinary 32-pounder guns, only two shots pierced the armour at the joints of the plates, and these were then so spent, that they dropped on the deck of the ship without reaching the other side. It is not known that any experiments were made on the armour of "La Gloire;" no doubt, the actual experience gained from the iron-coated floating batteries, at Kinburn, was considered of more value than any which could be obtained from firing against a target, under circumstances that could scarcely occur in actual warfare.

The "Warrior" target, like the plating of "La Gloire," was based upon the experience gained by the French floating batteries at Kinburn, and half an inch was added to the thickness of the plates, as an allowance for the improvements in artillery; making  $4\frac{1}{2}$  inches total thickness. The plates were wider, and the iron skin was placed behind, forming the side of the iron "Warrior." This target was subjected to the fire of the ordinary Armstrong and smooth-bore guns; the plates were driven in from the bolt heads, and were bent and buckled in a manner that proved their admirable qualities, but the bolts were not broken, except when struck by shot, and the skin remained intact. This was the great triumph of armour plating, which proved that the iron-coated ships, then in existence, were invulnerable under circumstances very unlikely to be reached in an actual naval battle. Subsequently, experiments were tried with the 156-pounder gun, and the three shots fired at the target punched a clean hole through the plate, and lodged in the backing, but did not penetrate the iron skin behind.

In the second method of constructing iron war ships, the best structure of the ship exclusively has been kept in view, and it has been

endeavoured, by increasing the thickness of the structure, to render it shot-proof, without sacrificing any of the materials for that purpose, but retaining the use of their whole strength in the ship. This was a very likely course for either an engineer or a ship builder to follow, and those who took up the subject from a mechanical point of view have more naturally adopted this system, which may be called the structural system; while the artillerist took up the former plan of simple iron armour, neglecting structural considerations.

Experiments on armour plates were made in the United States, at the beginning of the present century, by Mr. Stevens, the father of the present system of armour-plated ships; and the "Stevens Battery" was constructed at a later period by the American government, in consequence of those experiments. The ship was only half finished when its construction was discontinued; but since the agitation of this question in America, several experiments have been tried, to test the peculiarities in the construction of this vessel, by subjecting a target, of similar construction, to the fire of the heaviest American naval guns. This armour is  $6\frac{1}{2}$  inches thick in all, being composed of a 2-inch plate, with a number of  $\frac{3}{4}$ -inch plates behind it. The "Stevens Battery," like the "Warrior," is an iron ship, and between the iron skin and the armour there is a timber backing of 14 inches of locust timber. The target was placed on a slope of  $27\frac{1}{4}^{\circ}$  to the horizon, and fired at from a distance of 220 yards, by a 10-inch service gun, weighing 88 cwts., and subsequently by a Parrot rifled gun, of  $6\frac{1}{2}$  inches bore, weighing 86 cwts. The shot from the 10-inch service gun was solid spherical shot, weighing 124 lbs., with a charge of 11 lbs. of powder. The deepest indentation made by this shot in the armour was  $1\frac{1}{4}$  inch. Only 100 lbs. shells were fired from the Parrot gun, with 10 lbs. of powder, and they made an indentation only 1 inch deep. The slight effect produced upon the Stevens armour must be attributed to the great angle at which it was placed, and the low velocity which 124 lbs. shot would have when fired with only 11 lbs. of powder. The Americans, however, still believe that a number of thin plates, properly backed, are better able to resist shot than one plate of equal thickness; which can only be considered to arise from an inability at present to forge or roll thick, soft, and homogeneous plates of large dimensions.

The armour of the "Merrimac," although it was designed simply for resisting shot, must necessarily, from its peculiar formation, add to the strength of the ship. It was not formed, as is generally supposed, of railway bars, but in a manner much more effective and ingenious. Bars of iron, 6 inches wide and  $1\frac{1}{2}$  inch thick, were placed vertically on the side of the ship, and another outer layer of bars, of the same width but  $2\frac{1}{2}$  inches thick, crossed the lower layer at right angles; the whole being bolted, at each intersection, to the side of the ship by  $\frac{3}{4}$  inch bolts or screws. This armour seems to have stood remarkably well against the heaviest shot of the ships of war to which it was exposed, but fired at low velocities; for as far as it is known, no shot, fired from the "Congress" or the "Monitor" pierced the side. It forms probably the cheapest armour that can possibly be constructed, and has been introduced for fortifications by Captain Inglis, where weight is of no consequence and cost is everything. In the armour for ships of war, however, the case is reversed.

The third method of constructing armour comprises the plans devised in the belief that nothing but thick armour plates, perfectly solid, can be shot proof. In this conviction, it has been attempted to connect the iron armour directly and immediately with the iron hull of a ship, so as to avoid wood backing, with its rapid decay, its bad fastening, and its bad structural qualities, and so as to make the entire hull and armour one homogeneous mass of iron, that it may, as a whole, possess vast strength and great durability. When this is done, the enormous cost of a fleet of large vessels will not be perilled by the chances of premature decay, and the ships will not be burdened by useless loads of material. Three plans have been tried for this purpose. One is that of the Iron Plate Committee, who were to try the question of iron against wooden backing. A second plan, adopted by Mr. Samuda, may be called the thick plate structure, because it takes the thick plates of the armour, and by scarfing them from the inside, builds the upper part of the hull from the armour plates, so that they form the ship itself. The third plan, by Mr. Scott Russell, may be called the incorporation structure, because the hull of the ship is here built up quite independently of the armour; and recesses are prepared in this structure into which the plates are let as into cells, and the edges of the cells are then rivetted down over the plates, in such a manner as to incorporate the plates into the previously existing structure. By this plan, the backing and fastening form parts of the ship, and the armour plates communicate as much strength as one uninterrupted rivet all round the edge can give them.

The Iron Plate Committee, knowing the advantages to be derived from the substitution of an iron for a wooden backing, designed an iron target, which, in every way except the wood backing, was on the same principle as the "Warrior" target. The bolting was similar, and there were ribs at the back; the only difference being, that a little less material was put into the skin and a little more into the ribs. The result proved the utter insufficiency of the bolting, since 8 out of the 46 bolts, holding on all the armour plates, snapped off at the first round. It also proved that an iron target, formed in this manner, was not an improvement on the "Warrior" target, so far as resisting shot was concerned. The target would probably have stood much better, if the backing and framing had been exactly the same as in the "Warrior," and had had  $2\frac{1}{2}$  inches of backing, with 10-inch frames, instead of only 1-inch skin and ribs of twice that depth.

Mr. Samuda's target, next experimented upon, differed from that of the Iron Plate Committee, in having  $5\frac{1}{4}$ -inch plates, and having a very different system of framing; the chief peculiarity being a strong thick plate at the edges of the armour, through which the numerous  $1\frac{1}{2}$ -inch bolts or rivets were fastened. The framing of this target proved inferior to that of the previous one, but the plates curled up in a much less degree, and stood better, excepting at the edges, where they were weakened by the bolt holes.

The target next tried was constructed on Mr. Scott Russell's plan of continuous rivetting, wholly of iron, and introduced the principle of fastening the plates without bolts. The armour plates, of  $4\frac{1}{4}$  inches thickness, are fitted in between wrought-iron bars of the same depth, which run longitudinally and vertically along the ship's side, and form

part of its structure. These bars are heated at the outer edge, and hammered down over the edges of the adjacent armour plates, in such a way as to form one continuous rivet, passing all round the edge of each plate. There are several other plans for holding plates without bolts, which differ only in their practical execution from that now described, but their principle is the same, and the trial of this may be considered in effect as a trial of them all. The result of experiments proved that the fastening stood perfectly, and that an iron target could be constructed entirely of iron, which could prevent the 156 lbs. shot, fired with 50 lbs. of powder, from passing through the armour.

Having now examined the effect of the shot upon all these different systems of armour plating, the writer would submit the following conclusions. In the first place, a thick plate must be employed on the outside of the target. As much of the armour as practicable should be put into the structure of the ship, but it must have a thick plate on the outside. The plate must not only be a thick one, but it must also be a wide one; in other words, the fewer cracks in the armour to begin with, the better. The large plates are, of course, very expensive, and it would be highly satisfactory if smaller ones could be made to do as well; but the 68 lbs. shot insists upon large armour plates if it is to be kept outside the ship.

The next fact is, that every bolt hole weakens the plate. A large bolt hole does not weaken it more than a small one; and if bolting is found to be the best mode of fastening, the bolts should be large, and there should be few of them. The holding of the plate is of more consequence in an iron than in a wooden target, for this reason, that the iron plate is driven bodily into the wood, and the only purpose which the fixing serves is to keep the plate from absolutely falling off. It would prove a very instructive experiment, and would not cost much, to have the "Warrior" itself subjected to the same test as its section at Shoeburyness, and then sent to sea, to try the effect of the rolling of the ship upon the loosened plates. The dockyards would also have an opportunity of finding out the easiest and most efficient method of repairing such an iron fleet.

It seems very remarkable, that in the construction of armour plating, such different mechanical proportions should have been adopted from those of other iron constructions; and that while 1-inch plates would be fastened together with 1½-inch rivets or bolts, a large plate 20 feet long, upwards of 3 feet wide, and weighing more than 5 tons, should be fastened on by only fifteen 2-inch bolts. Mr. Samuda's target was far less injured, and far less changed in general shape, than that of the Iron Plate Committee, for the simple reason that there were a larger number of bolts to hold the plate to the skin; but they were unfortunately so close together that a couple of shots, happening to strike the edges of the plates where they were weakened by the holes, one of the shots went clean through. In Mr. Scott Russell's target, constructed on the principle of fastening without bolts, the face of the target was less disturbed. The area of fastening or bolting to a given plate on this principle is twelve times that of Mr. Samuda's, and 25 times that of the Iron Plate Committee's target.

The effect of shot on a target having wooden backing is to expend all its force on the armour plate, which is twisted, and bent, and curled

up at the edges ; but the iron skin remains intact. In the iron target, on the other hand, the skin and backing divide the work with the armour plate, and while the skin is broken through, the armour plate remains but little injured ; and, probably, although several shots did go through the two iron targets, if the firing were continued on them as well as on the "Warrior" target, the latter would be smashed in long before either of the former.

Whenever, therefore, ships come to be built entirely of iron, as will be the case at some future time, it is submitted that they must have the following qualities : the armour plates must be wide, there must be no bolts, the fastenings must be large, and there must be an inner skin, to prevent the pieces of iron from flying among the crew. Such an armour will then be superior, in resisting power, to that of the "Warrior," adding to the strength of the ship instead of detracting from it, having a skin uninjured, and independent of the armour ; and it will cost nothing for repair, but will last for ever.

It is important to glance at the power of shot, fired at high velocities, to penetrate iron armour, and the capabilities of the iron armour for resisting solid shot. Not much is known positively respecting this, but the following facts are tolerably well ascertained : that the 110 lbs. Armstrong shot has a velocity of 1200 feet per second, the 68 lbs. a velocity of 1580 feet per second, and the 156 lbs. a velocity of 1700 feet per second ; and that these shots have respective penetrating powers of 158, 170, and 430. It is also believed that, while the penetrating power of shot is as the square of its velocity, the resisting power of a plate is as the square of its thickness. This has not been absolutely proved by experiment, but is probably not far from the truth, and any error is due to the difficulty of manufacturing thick plates as homogeneous as thin ones. Assuming, then, the two following data,—that the 68 lbs. shot just does not pierce a 4-inch plate, and that the 156 lbs. shot just does not pierce a  $4\frac{1}{2}$ -inch plate backed by 3 inches of iron, it can be determined approximately what thickness of plate and backing would be required to stop a given shot having a given velocity, and what size of vessel would be needed to carry such armour, and also to possess all the qualities necessary in a ship of war. At present, the shot fired from the most powerful gun yet made is stopped by a  $4\frac{1}{2}$ -inch armour plate and 3 inches backing of iron, and the vessel necessary to carry such armour is of 7200 tons burden, and has a displacement of 10,500 tons ; a saving in weight of 600 tons being here made by the adoption of the iron backing.

Although, however, no shot has penetrated the strongest armour hitherto made, guns will doubtless be made to pierce it, for an Armstrong gun is now being manufactured to throw a 300 lbs. spherical shot, and guns will probably be made to throw 400 and 500 lbs. shots. On the other hand, although 4-inch armour is no longer invulnerable, it must not be considered that the thickness of armour cannot be increased, because a vessel could not carry the additional weight ; and the writer wishes to show, that when the more powerful guns are manufactured and used in large numbers, not only can the shot be stopped by armour of reasonable dimensions, but this armour can be carried by vessels of such moderate dimensions as to offer a fair prospect of the race between armour and artillery being continued for

the next twenty or thirty years. Thus, taking the gun now in progress for throwing a 300 lbs. spherical shot, which may be assumed to have a velocity of 2000 feet per second, at a range of 200 yards, this shot may, according to the preceding data, be stopped by a plate 7 inches thick, and backed by  $4\frac{1}{2}$  inches of iron. The minimum vessel required to carry such armour from end to end would be of 12,000 tons burden, and would be propelled by engines of 2000 horse power, at a speed of 15 knots per hour; 1500 tons weight would be saved in the construction by the use of iron instead of wooden backing. Assuming still further that a gun is made to throw a spherical shot, weighing 500 lbs., having a velocity of 2500 feet per second, such a shot could, on the same data, be stopped by 11-inch armour plates, backed by 8 inches of iron; and this armour could be carried from end to end by a vessel of 20,000 tons burden and 3000 horse power, which would be under the size already attained in the *Great Eastern*.

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Mr. W. Pole thought the paper that had been read gave a fair account of what had hitherto been done in the construction of iron armour for ships. As a member of the Iron Plate Committee, he would explain, that the reason why the Committee's target was not made with precisely the same backing as the "*Warrior*" target was, that it was wished to try some modification in the backing, but without adding to the weight of the target, which was intended to be in other respects as much like the "*Warrior*" target as it could be made.

The quality of the iron of which the armour plates were to be made was a subject requiring particular attention, and the first impression was generally that the plates should be hard, and even steel-clad ships had been proposed. This was, however, entirely a mistake; for the results of a large number of experiments tried by the Committee with iron and steel plates of all qualities proved most decisively that, instead of being hard, the proper material for armour plates was that which was as soft and as tough as possible. Hardness, whether in steel or iron, was quite out of the question. Steel plates had been tried, and they proved the worst that could be used for such a purpose; they broke up under the blow of the shot, and became entirely useless; semi-steel was slightly less objectionable, and hard iron was the next in order. The evil was, that all hard material cracked, whereas soft material bent about, and became indented without cracking; and for securing a safe protection, the object was to get plates that would bend without cracking. If the plates cracked, two or three shots would make them crack in different directions, so that pieces of the plates would fall off, and therefore a crack was the worst result that could be obtained. Accordingly, the best kind of plate for armour was that which was as soft and tough as possible, and toughness generally appeared to go with softness. The best descriptions of iron had been tried, and when they were soft they answered very well; but even expensive qualities of iron, if not soft, would not do, because it was softness that was indispensable. Hence, an important result arrived at was, that expensive qualities of iron were not necessary for armour plates, for it was possible to get iron of very reasonable cost which possessed the quality of softness sufficiently for this purpose.

With regard to the thickness of the armour plates, a general hope had been entertained, prior to actual trial, that the plan of building up the required thickness of iron by means of a number of thin plates bolted or rivetted together would prove successful, in place of a single plate having to be made of very great thickness. In this construction of armour the proper fastening together of the plates was a point of the greatest importance; and accordingly, in the target constructed on this plan, as described in the paper, the fastening was very carefully attended to. The holes were not merely punched, and the rivets driven in, but they were drilled with great care by Messrs. Cochrane, in the same manner as the plates of the girders made by them for the Charing Cross railway bridge; and screwed bolts, tapped through all the plates, were also tried. The principle of thin plates was thus tried in its best form up to a total thickness of 10 and 14 inches; but when the target came to be fired at, the result left no doubt that this plan of construction was a failure, and that the outside plate at any rate must be a thick one, and of a soft quality. The reason appeared to be, that the strength of a plate to resist the blow of a shot was something like the transverse strength of a beam supporting a weight, the strength being in proportion to the square of the depth of the beam or thickness of the plate; so that a single solid plate of great thickness possessed far more resisting power than a number of thin plates making up the same aggregate thickness of metal. The size of the armour plates should be made as large as possible, in order that the extent of edges might bear the least possible proportion to the area of the plates; because, if the shot struck the edges or corners of a plate, they were pretty sure to break off, but if it struck in the body of the plate, away from the edge, the iron had a better chance of resisting the blow without being damaged.

A good deal of enquiry had been made as to the best method of fastening on the armour plates, whether by bolting them on or by some other plan. In the Iron Plate Committee's target, the bolts soon gave way, and several plans had been tried for doing away with bolts, among which was Mr. Scott Russell's ingenious method of holding in the armour plate by a sort of continuous rivetting all round the edge, like the fastening of a picture in a frame, by means of iron ribs projecting from the backing; the plate was then put in, and the edges of the ribs rivetted over. This plan of fastening the plates had proved thoroughly successful, though it was a more expensive method; and bolting was certainly the simplest mode of fastening; but if bolts were used, they must be of large size for holding on plates of so great thickness. For joining the plates to one another, the plan of grooving and tongueing was adopted in the "Warrior," because it was thought that one plate would assist the other in receiving a blow at the joint. That, however, was found not to be the case, for instead of one plate assisting the other, when one plate was struck it broke the other, and therefore the plates were now simply made to butt together at the joints.

As regarded the question of wood or iron backing, the general impression, after all the trials, was that, in reality, the wood backing was very useful. There had been a desire to get rid of wood backing, and trials of iron backing had been made for that purpose; but the iron back-



ing of the Committee's target did not prove successful, and though that in Mr. Samuda's and Mr. Scott Russell's targets had succeeded better, it was still doubtful whether there was sufficient warrant for the exclusion of wood. The wood backing appeared to answer several useful purposes: for when the plate was broken by a shot, the wood backing entirely stopped the pieces, which would otherwise fly into the ship in fragments; these got imbedded in the wood and could not go further. Moreover, when a shot struck a plate, if it broke the plate it generally broke out a piece in a conical form, thus extending the fracture over a much larger area at the back of the plate; so that the blow was spread over a large surface of the wood backing, which had thus a better chance of stopping the broken piece of the plate, and still preserved the inner iron skin and the ribs of the vessel free from injury.

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At the General Meeting held at Birmingham on the 6th of November, 1862, C. F. BEYER, Esq., in the chair, the following paper, "*On a packing for pistons of steam engines and pumps*," was read, by Mr. GEORGE M. MILLER, of Dublin.

THIS packing consists of two rings, pressed outwards against the cylinder by the pressure of the steam as it acts on the alternate faces of the piston, without the use of any springs. The piston, as used by the writer in the locomotive engines on the Great Southern and Western Railway of Ireland, is of cast iron, 2 inches in thickness and 15 inches diameter. Two square grooves are turned in the edge of the piston,  $\frac{1}{8}$ -inch in width and  $\frac{1}{8}$ -inch apart, and a corresponding steel ring is fitted into each groove, the rings being divided at one part with a plain butt joint, and sprung over the piston into their places. Two small holes,  $\frac{1}{8}$ -inch diameter, opens from each face of the piston to the bottom of the nearest groove, whereby the steam is admitted behind the packing ring; thus pressing it out against the cylinder, so long as the steam is acting upon that face of the piston. The alternate action of the two rings is continued as long as the steam is acting on the piston, one of them being always pressed steam-tight against the cylinder.

Pistons have also been fitted with brass rings,  $\frac{1}{4}$ -inch in width and  $\frac{1}{16}$ -inch in thickness, the piston being  $3\frac{1}{2}$  inches wide.

Another form of the piston has been used in cases where the piston is desired to flush on both faces, or to fit a cylinder with flat covers: in this a circular flat head, forged upon the piston rod, is fitted between the turned faces of the two halves of a cast-iron piston, which are held together by turned pins rivetted over, forming a hollow piston flush on both faces, fast upon the piston rod, and without any loose part besides the two packing rings. The ends of the rings, where divided, are made with a butt joint, or with a lapped joint. The piston body is turned, to pass through the cylinder easily; and the joints of the rings have been found to be practically steam-tight. In some cases the joints have been tongued, but this has not been found requisite: the butt joint has invariably worked well, whilst it has the advantage of perfect simplicity of construction. In pistons where the packing ring travels over the opening of the cylinder port, a small stop is fixed in the bottom of the groove, entering a short slot in the packing ring, to pre-

ent the ends of the ring coming opposite the cylinder port, but still leaving the ring free to travel round a little in the piston grooves; it is, however, preferred for the packing rings not to travel over the cylinder ports.

Another form of joint for the packing rings intended to be used in a stationary engine, with cylinder 16 inches diameter, is fitted with brass stop piece, 1 inch thick and 4 inches long, which is placed in a recess at the back of the joint, serving as a cover to the joint at the top and bottom by projecting  $\frac{1}{4}$ -inch in thickness on each side.

These steam-packed pistons have been used more than seven years on the locomotives of the Great Southern and Western Railway, and have proved so satisfactory and advantageous, that their use has been extended to all the 94 locomotives working upon that line. The following are the results of the working in the engines running from Dublin, as regards the durability of one set of rings, the period of their wear, and the mileage of the engines whilst wearing them out. Nineteen engines, working with one set of steel rings, averaged 33,020 miles and 16 $\frac{1}{2}$  months' running; one engine having worked for 3 years, and run as much as 98,073 miles with one set of packing rings. Five engines, working with one set of brass rings under the same circumstances, averaged 30,986 miles and 19 months' running, the greatest work amongst them being 2 $\frac{1}{4}$  years and 43,197 miles. Twenty other engines, with steel rings, which are still in use, have also averaged 40,441 miles and 21 months' work,—one of these having worked for 3 $\frac{1}{4}$  years, and run 94,399 miles with the original set of rings.

The general result of the above is, that one set of steel packing rings have lasted 37,000 miles and 19 months' work; and one set of brass rings 31,000 miles and 19 months' work; the difference in durability being about 16 per cent. in favour of the steel rings. In some of the individual cases of the pistons with steel rings, a very considerable variation from the average result of 37,000 miles is found in the durability of the packing rings, some of them having lasted 2 $\frac{1}{2}$  times the average, and some only as much below the average. In the case of the brass rings, the variation is not so great, amounting to 1 $\frac{1}{2}$  times the average in the highest, and about as much below the average in the lowest. This variation in wear has not been fully accounted for: it may have occurred from a different character of metal in the cylinders, from priming of the boiler, and from the presence of grit in the water; but the writer has reason to believe that the rings have been frequently put in to work and set with a pressure upon the cylinder from their own elasticity, thus causing a source of wear. It is found the best plan to turn the rings to the exact diameter of the cylinder, and to put them in without any spring upon them, so that they are not subjected to any wear except when the steam is acting on them. The steel rings are now slightly tempered, to admit of their being sprung into the grooves without altering their form. In all these pistons the steel packing rings were  $\frac{3}{8}$ -inch thick originally, and  $\frac{1}{4}$ -inch wide, and they were worn down to about  $\frac{1}{8}$ -inch thick in the thinnest part before being removed. The brass rings are worn down from  $\frac{1}{4}$ -inch until they are  $\frac{1}{8}$ -inch thick. Specimens are exhibited of steel rings from our engines that have worked 38,000, 61,000, 84,000, and 96,000 miles respectively since first put into the pistons. It must be re-

marked, that when opportunities occur, as when engines are under repair, the rings are taken out and re-set to the size of the cylinder.

It is found in practice that two steam ports of  $\frac{1}{8}$ -inch diameter are quite sufficient for each of the steel packing rings. The rings must be made to fit easily in their grooves, so as to move freely, with a clearance of  $\frac{1}{16}$ -inch at the bottom of the grooves, for the steam to pass round behind the rings. No difficulty has been experienced from the steam passages becoming stopped up with a moderate use of tallow in the cylinders.

The use of this piston packing in locomotive engines has been productive of economy by reducing the friction, and by prolonging the wear of both pistons and cylinders. It will be observed, that only one ring is in action at the same time, and that when the steam is shut off, as in descending inclines and approaching stations, the piston is free to move without any friction. The cylinders of the four engines from which the specimen rings exhibited have been taken show a highly polished surface, are very little worn, and are nearly parallel throughout. The operation of putting in these rings, so as simply to fit the cylinder, is extremely easy; whilst great care and skill are required in giving springs the requisite degree of elasticity, and in making them maintain it.

A number of stationary engine pistons are working with these packing rings, and they have proved very durable and thoroughly satisfactory; giving an advantage in reduction of friction, and in preserving the cylinder face in perfect condition. In one case of the engine of the Oldbawn Paper Mill near Dublin, with vertical cylinder 18 inches diameter and  $2\frac{1}{2}$  feet stroke, working with 50 lbs. steam, the cylinder had previously been worn considerably out of truth and much grooved, and one of these pistons was put in having two steel rings of  $\frac{3}{8}$ -inch width and  $\frac{3}{8}$ -inch thickness, and was in constant work for four years without the packing rings requiring renewal. They have lately been taken out for examination, and were found to be still  $\frac{1}{8}$ -inch thick; and the cylinder, from its previous defective condition, has been brought completely to truth throughout, with a highly polished surface.

These packing rings have also been used for four years for pump buckets, and have proved very satisfactory. In one case of a double-acting pump, 8 inches diameter, the two packing rings are of brass,  $\frac{3}{8}$ -inch wide and  $\frac{1}{8}$ -inch thick, and are pressed out by the pressure of the water acting at the alternate faces of the bucket through two ports,  $\frac{1}{8}$ -inch diameter, similar to those in the steam pistons. This pump had two years' constant work at quarries and bridge foundations upon the Great Southern and Western Railway, before the packing rings required renewal.

In the case of single-acting pumps, the bucket has only a single packing ring with ports opening from the upper side.

An application of the same construction of packing has also been made to the gland packing of a 9-inch pump plunger; two brass packing rings being used,  $\frac{1}{8}$ -inch wide and  $\frac{3}{8}$ -inch thick, just like the piston packing rings; except that they act in the opposite direction, being pressed inwards upon the plunger by the pressure of the water through the ports.

The next paper read was, "*On machinery for the manufacture of gun-stocks*," by Mr. THOMAS GREENWOOD, of Leeds.

OF all the various articles into which wood is shaped by machinery, few have presented greater difficulties than gun stocks. The irregularity of their form, and the intricate shaping required to receive the metallic parts of the gun, have rendered so many separate operations necessary, requiring such a variety of machines, that it can scarcely be matter of surprise that gun stocks have hitherto been made by hand in all the leading gun-making localities both in this country and on the Continent; and this might have continued to be the case, had not other reasons arisen, besides the economy of labor, to induce the introduction of machinery. In military arms, where very large numbers of one pattern are required, the desirability of making all the parts interchangeable naturally suggested itself; but it required years of thought before this principle could be fully developed and practically carried out. In order to carry it out practically, it is required not only that the gun stock should be made perfect, but that each of the metallic parts should be equally perfect. Hence, the manufacture of each separate part by machinery had to be studied and accomplished, involving no small amount of ingenuity to make perfectly, by machinery, what had hitherto been done easily and cheaply by hand, though wanting in the exactness necessary to form the parts of an interchangeable gun. Possibly, if the demand had not been for a national purpose, the manufacture of machine-made guns might yet have been unattained: whatever the cause, however, gun-making by machinery, on the interchangeable principle, is now successfully accomplished.

The object of the present paper is to explain the process of making gun stocks by machinery, and to describe some of the processes in detail. To secure success, there is one condition which must be rigidly observed throughout this manufacture, namely, perfect accuracy in each operation. In a manufacture where twenty operations are built upon one another, each depending for its accuracy upon a previous one, it is evident how important this condition is to success. The following is the entire series of successive operations, 23 in number, which are performed by a set of machines for shaping and finishing the stocks for rifles—each operation advancing the stock a step further from the original rough bar of wood towards its completion in the required form.

1. The upper edge of the stock is cut nearly in a line with the centre of the barrel, and is finished with an oblique cross cut at the breech: the muzzle end is also cross cut nearly to the correct length. This operation is called "slabbing."
2. The centres are made in the butt and muzzle ready for the rough-turning machine.
3. The fore end of the stock is rough turned.
4. The butt end of the stock is rough turned.
5. Five flat pieces are cut on the right-hand side of the stock, and two on the left side. This operation is called "spotting."
6. The hollow bed to receive the barrel is cut out, and the tang of the breech screw is let in. This operation is called "bedding the barrel."
7. This is a hand operation, consisting in squaring the conical recess made by the cutter in the previous operation, to receive the taper projection under the tang of the breech piece; and the corner is rounded off to fit the hollow under the tang.
8. The stock is sawn to the exact length at both ends, and the butt end shaped to the form of the butt plate, by means of a revolving cutter.

9. The flat sides are planed where the lock plate is inserted, and the side caps are let in, which act as nuts for the screws holding on the lock: also the upper edges of the recess for the barrel are profiled, and the upper and under edges of the butt end of the stock.
10. The tang of the butt plate is let in, the three holes for the screws are bored, and the two end holes also tapped.
11. The corner under the tang of the butt plate is rounded off by hand.
12. The lock is bedded.
13. The end of the curved recess for the cone seat, where it joints against the lock plate, is squared by hand.
14. The trigger guard is bedded and the screw holes drilled, and the recess for the trigger plate is cut, and the stop for the ramrod let in.
15. The stock is cut under the bands from a copy, and the nose cap is let on.
16. The stock is cut between the bands.
17. The arris, at the extreme muzzle end of the stock under the flange of the nose cap, is taken off by hand.
18. The butt end of the stock is finish-turned in a copying lathe.
19. The fore end of the stock, between the lock and the first band, is finish-turned in a copying lathe.
20. The groove is cut for the ramrod.
21. The recess to receive the ramrod spring is cut out, and the transverse pin hole, for fixing the spring, is bored.
22. The hole for the ramrod is bored in continuation of the groove.
23. The holes for fixing the lock plate are bored, and also the screw hole for the tang of the breech screw, the screw hole for the nose cap, and the pin hole to fix one end of the trigger guard.

In the lock bedding machine (for performing the 12th operation of cutting out the bed or recess to receive the lock), five separate operations are successively performed towards cutting and shaping the recess for the lock, with one fixing of the gun stock in the machine. Five cutters or drills are fixed each in a vertical spindle, set at equal distances from a common centre, and carried on a vertical slide. These drill slides are mounted on the circumference of a circular cage, which turns round on a vertical central shaft. Each drill slide has a circular or transverse motion to a short extent round the circumference of the cage, and also a vertical motion, and is moved, both transversely and vertically, by a hand lever, provided with universal joints. A plain cylindrical driving wheel at the top of the machine, turned perfectly true, drives each of the five drills by friction, by means of a small driving roller on the top of the drill spindle. The main driving wheel runs loose on the central shaft, being driven by a belt pulley above. The vertical drill slides are each held up by a coiled spring, which lifts the roller of the drill spindle out of gear with the driving wheel when not in use, so that the drill does not revolve until pressed down by the hand lever.

The gun stock is fixed longitudinally upon a horizontal sliding table, and is held in its proper position by a portion of a barrel and tang, sufficient to keep it firm when pressed home by an excentric. The horizontal table can be moved freely backwards and forwards longitudinally, by means of a toothed segment worked by a hand lever, and gearing into a rack on the under side of the table. Alongside the gun stock, upon the same sliding table, is fixed the pattern or "former," as it is termed, made of hardened cast steel, which is the counterpart, in size and form, of the recess to be cut in the stock. The shape of the pattern is followed by a tracer, fixed parallel to the drill. Hence, if the horizontal table be moved longitudinally, and the drill slide trans-

versely and vertically, by the combination of these three movements every part of the pattern can be traced by the tracer, while a facsimile of the pattern is being cut in the wooden gun stock by the drill. The five drills of the machine are all of different sizes, for cutting the different portions of the recess, and each drill is accompanied with a corresponding tracer of the same size. When one drill has finished its own particular portion of the work, the circular cage is turned round by hand, to bring the next drill into operation upon the gun stock: the cage is locked by a spring as each succeeding drill is brought round into position, and is then released by a treadle. A small fan, with two air tubes, blows away the cuttings from the drill and also from the pattern.

For cutting the lock recess, it is absolutely necessary that the cutter and the tracer be of exactly the same size, otherwise the recess will not correspond precisely with the pattern. In order to maintain perfect accuracy of the recess cut, the sockets in three of the drill spindles are bored  $\frac{1}{64}$ th inch excentric, and the shank of the cutter is turned to the same amount of excentricity with the cutting part. The end of the spindle nose is graduated through half its circumference into fine divisions, and a zero line is made upon the cutter; and when the cutter is new or full size, and placed so that the two excentrics counteract each other, the cutting part is perfectly true. But as soon as the cutter has been made sensibly less by sharpening, it is turned round one or two divisions in the drill spindle, so as to impart just as much excentricity to the cutting tool as the sharpening has reduced it in diameter, thus causing the cutter to continue to describe a circle exactly the size of the tracer.

The following are the operations performed by each of the five drills in succession, in order to cut out the whole of the recess for bedding the lock. The first drill cuts out the recess to receive the lock plate; and the tracer for this operation is provided with a cross piece, which reaches across the entire width of the recess in the pattern, so as to prevent the tracer from being pushed down into the pattern lower than the depth of the lock plate. The second drill bores out the hole for the shank of the "sear," and also a hole for the sear spring screw. The third drill bores two holes for the bridle screw heads. The fourth drill cuts out the principal recesses below the lock plate, and partially cuts out the curved recess for the cone seat. The fifth drill cuts out the rear end of the recess, to make room for the heel of the sear spring, and also cuts out a small notch on the lower side of the recess, to receive the end of the swivel when the hammer is down. The first, fourth, and fifth drills are the three which have their shanks turned excentric to allow of adjustment for wear; while the second and third drills, having merely to bore out plain circular screw holes, are fixed concentric in their spindles.

The operation of cutting the recess for the gun lock is performed with great rapidity by this machine, which will recess upwards of 1000 gun stocks per week. This lock bedding machine may be taken as a type of the machines arranged for copying from the interior of a pattern: several of the machines used in the manufacture of gun stocks are of similar construction.

The shaping machine, for shaping the gun stock between the bands,

which is the other machine selected for description in detail, is one copying from an exterior pattern, and performs the 16th operation of shaping the external portion of the stock between the bands.

In this machine, the pattern to be copied consists of a series of cams, mounted upon a horizontal shaft immediately over and parallel to the gun stock; and the shape of the pattern is transferred to the gun stock by revolving cutters, mounted in rocking levers, at the extremities of which are the tracers that follow the circumference of the pattern cams. The gun stock is fixed upon a mandril, which corresponds exactly with the gun barrel, and fits precisely into the groove cut in the stock, in one of the earlier operations, to receive the barrel; and this barrel groove serves as the fixed accurate basis for the present and all the subsequent operations, as well as in the previous operation of bedding the lock, thus ensuring absolute identity in all the stocks.

The mandril is supported by three hollow journals, which revolve in three bearings on the frame of the machine, and the gun stock is slid inside these journals upon the mandril, and is held in its place by a spring at the muzzle end, and by two set screws in the other two hollow journals.

There are four revolving cutters, mounted in four rocking levers. The bearings of the cutter shaft are carried in a forked swivelling frame inserted in a socket in the top of the rocking lever, so that the cutter shaft can be set exactly parallel to the axis of the gun stock or slightly inclined to it, according to the shape of the stock. On each prong of the swivel frame is an adjustable tracer, for tracing the form of the pattern cam. The cam shaft and the mandril are geared together by a pair of spur wheels at each end, and the gun stock is turned round through half a revolution by a hand wheel as the shaping proceeds, the cutters being driven by belts from bottom pulleys. The cutting blades are screwed to a cast-iron block, which is shaped with an undulating surface, so as to present the cutting edges at an angle to the axis of the gun stock, and thus ensure a smooth cut across the grain of the wood with somewhat of a paring action.

The portion of the gun stock next to the bands is first shaped by the cutters on one side of the machine, which are brought up by means of a treadle and the flat steel spring. The thin end of this spring bears against the lower end of the rocking lever, and presses the tracers against the pattern cams. The spring ensures the tracers keeping in close contact with the cams throughout their revolution, whilst the treadle is kept pressed down by the foot; it also ensures a softer action of the cutters as they are brought up against the wood. A counter spring, on the opposite side of the rocking lever, serves to keep it steady, and to throw the cutters out of action when the treadle is released. The second pair of cutters, on the other side of the machine, is then brought up into action in the same manner by the other treadle; and the gun stock, being turned round through the remaining half revolution, is thus reduced to the finished shape in one revolution of the hand wheel.

The other machines of the series are similar in the principles of construction, differing merely in the details of arrangement for performing the special operation intended. By the employment of machinery in this manner, strict accuracy of work is obtained, and all the separate

portions of the gun are interchangeable with any gun stock. Although this machinery requires much greater delicacy and accuracy of workmanship, and much more careful fitting than ordinary wood working machinery, and is consequently much more expensive, yet the saving in cost of production of gun stocks fully justifies the large outlay incurred in the first cost of the machinery, which is amply repaid by the intricate nature of the operations performed, and the rapidity and exactness with which the work is produced by these machines, as has already been proved by the success that has attended the Government factory at Enfield, where similar machinery is employed for the manufacture of gun stocks.

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Mr. Greenwood exhibited the lock bedding machine in complete working order, together with the shaping machine, for shaping the gun stock between the bands; and also an entire set of the gun stocks from each stage of the manufacture, showing the condition of the stock after each of the 23 operations, advancing step by step from the original rough wood blank to its final completion in the required form. He explained, that of the 23 operations, 19 were performed by machinery, and 4 by hand, namely, Nos. 7, 11, 13, and 17 in the series described in the paper; and these latter it was expected would be reduced shortly to only one hand operation of very small amount.

The Chairman thought the subject of the paper was a very interesting and important one for the gun makers of Birmingham; and he enquired whether any of the machines described were at work there for the manufacture of gun stocks.

Mr. Greenwood replied, that there were not any of the machines at work yet in Birmingham, but a complete set of them was in operation at Enfield, where they had been in use for several years; and also a nearly similar set at the London Armoury Company's works in London. The machines now exhibited were constructed for making only one length of gun stock, and some modifications had therefore been introduced for simplifying the construction and mode of driving; but the machines in use at Enfield would take in three different lengths of gun stocks, namely, carbines, short Enfields, and ordinary long Enfields, the last of which formed the greater proportion of the guns manufactured. At Enfield, with two sets of the machines, 2000 gun stocks per week, on the average, were produced; but at that rate of work the machines were not fully employed, and in full work one set of machinery would produce 1200 gun stocks per week. At present the gun makers of Birmingham had to pay a high price to have their gun stocks made by machinery in London, in order to secure greater accuracy and finish of workmanship than was obtained in hand work.

The gun stock machinery was of American origin, and the American government had been occupied for the last twenty years in perfecting the manufacture of guns by machinery at the armouries of Springfield and Harper's Ferry. At the time of the Crimean war, Mr. John Anderson, Col. Burn, and Lieut. Warlow were sent over from England as a commission to investigate the manufacture of arms in the United States; and an arrangement was made with the Ames Company to



supply two or three sets of machines to this country; the American government consenting to furnish all the information in their power on the subject. The first attempts, however, at the use of machinery proved fruitless, as several of the machines first made failed, and had to be abandoned; but the work was resumed, and resulted in the machinery now in use in the Enfield factory. The original machinery was intended to turn out 500 gun stocks per week, and had since then been supplemented by further machinery from America, and also from the author's own works, so as to produce now 2000 gun stocks per week. The machines supplied from his own works had been constructed for the purpose of making different lengths of Enfield gun stocks in the same machines, so as to prevent the necessity of having different sets of machines for different sizes of gun stocks. Two or three other sets of machinery were also made subsequently by the Ames Company, but none had been got successfully to work except that supplied to the London Armoury Company; and the Russian government purchased a set through Col. Colt, which had also not been brought into actual operation at present. The machinery at Enfield was at first worked under the superintendence of men sent over from America; but more guns were now being turned out there than at that time, and the machines were working very successfully, producing very smooth and accurate work.

Mr. Greenwood observed that the shape of the work could be changed to a considerable extent in the same machine by simply changing the pattern that was being copied, and having the cutting tools so shaped that they would follow any pattern required. One essential condition of success was, that the cutters should be adjusted with extreme accuracy, and maintained with a very sharp cutting edge; and they were driven at a high speed, making from 5000 to 6000 revolutions per minute in the lock bedding machine, and about 2000 revolutions per minute in the shaping machine. The cost, he said, of a set of the machines complete, with all accessories, would be about £8000 for producing 500 gun stocks per week. The machines were all arranged in a row, so that the work was passed on from one to another successively throughout the entire series; and one considerable difficulty that had been met with was to get some simple and efficient means of readily fixing the gun stock in its proper position in each machine, so as to ensure exact correspondence in the shaping of all the stocks. The first four operations consisted simply in reducing the original wood blank roughly to the shape of the stock, and no accuracy of adjustment was needed in them; but in the fifth operation, termed "spotting," the accuracy commenced,—the "spots" or flat places cut on each side of the stock in this operation being portions of one plane, and forming the basis of adjustment for the sixth operation, in which the groove was cut for the barrel, the stock being fixed in the proper position in the machine by means of the spots previously cut on it. The barrel groove then became the basis for all the subsequent operations, each machine having a mandril exactly corresponding with the gun barrel, upon which the stock was readily slid endways, and pushed home to the squared end of the groove, and then fixed in its place.

In answer to a question of the Chairman, Mr. Greenwood said, that

there would be no difficulty in keeping the bearings completely in order, as all the bushes were of hardened steel, and the work was fitted with such accuracy that the circular cage and the drill slides were moved easily by a light touch. The drill spindles had a conical neck at the bottom end, running in a conical steel bush hung on centres, and the top end of the spindle ran in a parallel bush, with a loose collar that took the end thrust of the drill, so that the spindle was kept perfectly free, and ran very smooth and steady, without any strain under the high speed at which it was driven; a lock nut at the upper end gave the means of taking up the wear of the conical bearing at bottom, and the collar at top. The small driving friction rollers at the top of the drill spindles were made of ebonite, vulcanised india-rubber with an extra quantity of sulphur in it, which was a very hard and durable material, well adapted for the purpose.

Mr. F. J. Bramwell asked whether that mode of driving the drill, by means of a friction roller driven by contact with the central driving drum, did not make the drill slide less easy to move laterally: he remembered, in the machines made by the Ames Company, a separate strap, with fast and loose pulleys to each drill spindle, was used in similar cases, that the movement of the drill slide might not be hindered by the friction.

Mr. Greenwood said, the tendency of the driving drum to carry the drill slide round with it did not produce any difficulty in working the machine, and the drill slide was moved in either direction by the handle with the greatest ease and lightness; and when the handle was let go, the slide was raised by the spring behind, and the friction roller thereby lifted out of contact with the driving drum. With a separate strap to each drill there was the objection that each strap had to be thrown in and out of gear successively; and the plan now adopted had therefore the advantage of greater simplicity and facility of working.

Mr. F. J. Bramwell observed, that the advantage in machine work was very great, in the facility and rapidity of fitting the work together, on account of all the parts being strictly accurate as duplicates; and the price and time of putting a gun together complete would give the best idea of the perfect uniformity and finish with which the several portions of the work were produced by the machinery. He understood that the cost of putting together at Enfield was now reduced to only  $1\frac{1}{4}d.$  each, since all the parts were exact duplicates of one another, in consequence of being made by machinery. He enquired what was the time occupied in putting each gun together complete, when made by machinery.

Mr. Greenwood replied, that the time required for putting together a gun was now only six minutes, including the ramrod, bayonet, and oiling over the stock. The lock was finished and put together beforehand ready for the workman, and the screw holes being ready drilled in the stock, all he had to do was to put it into the recess in the stock, and screw it in. All the other parts of the gun furniture were taken up promiscuously from a lot of each sort, and put into the stock, and the only tool used by the workman was a hand brace, with a screw-driver in it.

Mr. J. Fernie observed, that he had been much interested in seeing the machinery at Enfield, and thought the lock bedding machine now

exhibited was a very beautiful specimen of machinery and a decided improvement upon the machine used there, as it had no loose straps in connection with the several drills, in consequence of the drills being driven by friction rollers by the central driving drum, and it was altogether a better arranged machine. The mode of compensating for the wear of the drills, by fixing each drill with an excentric shank in an excentric socket in the drill spindle, was also an ingenious contrivance, affording the means of maintaining constantly the correct size of the cutter, and ensuring perfect accuracy of work, by turning the drill round a little in the socket, when its diameter had become reduced by sharpening. A shaping machine, similar in principle to that exhibited for shaping the outside of the stock, had been employed for some time at Derby, for shaping wood spokes for carriages wheels, by means of revolving cutters copying from a pattern. He enquired, what sort of copying lathe was used for turning the butt end of the stock, and how the polishing of the stock was done to finish it ready for use.

Mr. Greenwood replied, that the stock was merely rubbed with sand paper, to remove the slight roughness of the surface left by the grooving action of the cutters; and it was then polished by hand in the ordinary manner. The lathe for turning the butt end of the stock was one of the ordinary Blanchard copying lathes, the invention of which, though generally supposed to belong to America, really belonged to South Staffordshire, the lathe having, he believed, been originally invented by a gentleman named Rigg, living not far from Birmingham, for the purpose of turning shoe lasts; the invention was afterwards taken out to America, whence it returned again to this country under its present name of the Blanchard lathe, and was now employed very extensively in large numbers of manufactures.

Mr. F. J. Bramwell remembered having seen a lathe with a revolving cutter, mounted on an oscillating frame, in the Adelaide Gallery, in London, about twenty-five years ago, which copied from a complete iron pattern of the required shape, and was capable of undercutting to a certain extent; and the same principle had been applied in Jordan's wood-carving machine. In ordinary wood-working machines, however, the work produced was not required to fit together: but in the gun stock machinery now described, absolute truth of workmanship was necessary, so that the several parts of the gun might fit in the stock with perfect accuracy.

## LONDON ASSOCIATION OF FOREMEN ENGINEERS.

5th September, 1863.

MR. JOSEPH NEWTON, ROYAL MINT, PRESIDENT, IN THE CHAIR.

The paper read, was by Mr. D. A. GETTLIFFE, "*On boiler explosions and railway accidents.*"

THE apparatus for the prevention of steam boiler explosions and railway accidents, forming the subject of this paper, was said to be the invention of M. Auguste Achard, C.E., of Paris, and was known in France under the title of the "*Embrayage Electrique.*" It was calculated to

maintain a constant level feed in steam boilers by automatic means, and without the assistance or supervision of the engineman. This regulator, as it might be termed, consisted of a ratchet wheel of peculiar construction, and which was keyed upon a spindle turning freely in its bearings. Right and left of the wheel were mounted loosely on the spindle, two wrought-iron levers, of about twenty inches each in length, and connected together by cross-pieces. A two-armed "click," supported by the levers, turned freely round an axis. The double click acted upon the ratchet wheel, which was furnished with two sets of teeth, turned in opposite directions to each other, and separated by a blank space. The click was fitted with a tail piece in the form of a fork, the two prongs of which were braced together by a cross rod. In the fork was mounted an "armature," which was provided with an opening, through which passed the cross piece. The armature was made of brass, and to it was attached a plate of soft iron, fitted in so as to be flush with the surface of the armature. Opposite to this latter was placed a horizontal electro-magnet, the poles of which abutted against the armature in such a way as that it (the armature) could only slide against the poles, without coming into immediate contact therewith. The part played by the armature was merely to act as a weight on the levers supporting the fork; for it would be understood that, when the electric current was in circulation, the armature would be suspended by its adherence to the electro-magnet, and thus relieve the fork of its weight. The suspension of the current, on the contrary, would cause it to drop on the cross piece connecting the levers, and thus alter the gravity of the fork. It was these alternations of the weight on the tail piece of the levers which caused the fork to act upon the upper or lower set of teeth on the ratchet wheel; or, in other words, to open or shut the feed-cock of the boiler. It was necessary that the fork should have continual motion—a kind of pump-handle movement, indeed—which could be effected by a simple contrivance (a small eccentric, for instance, attached to a running shaft on the general machinery.) The effect would be, that the compound ratchet wheel would be acted upon and moved in one direction when the boiler required feeding, and in the other when fed sufficiently. If all were going on well, the click would simply move over the blank portion of the wheel, and communicate no motion whatever to it. Advancing now to the general action of the contrivance, the reader proceeded to state that, when the current was broken off from the electro-magnet, the weight of the armature, operating upon the cross piece, would press down the tail piece of the levers carrying the click, which latter would rise and act with its lower arm upon the ratchet wheel. The consequence would be, that the wheel would turn from left to right to the extent of one tooth, or about half an inch, at each oscillation of the levers, until the blank space presented itself and stopped further movement. This would be at a point when the wheel had made one-fourth of a revolution. On the other hand, when the current was in circulation, the armature, in sliding against the poles of the electro-magnet, would bring the plate of soft iron into contact with the poles, which would then hold it firmly, and prevent the armature descending with the click during the downward oscillation of the levers. The tail piece would thus be relieved, and not have to support any weight while the

latter rocked in the opposite direction. It would follow that the upper arm would then act upon the wheel, and cause it to turn the reverse way,—*i.e.*, from right to left. It would thus become evident, that the two-armed click would act on the ratchet wheel, and cause it to move in opposite directions, whether the electric current were traversing the electro-magnet or not. "Now," said the reader, "the characteristic feature of the electric regulating apparatus is arrived at." The rising and falling of the float in the boilers of stationary or land engines controls the electric current, and causes it to circulate or be interrupted at the proper times. This result is obtained directly by the wires, which proceed from the pile or battery, being made to pass first to the float, instead of being connected immediately to the electro-magnet. The float itself was connected by a rod with an index, on the lever of which was mounted a piece of wood, faced on one side with a brass plate. On another piece of wood, in the form of a rocking lever, and moving on an axis, was a second plate of brass. The electric wire, from one of the poles of the battery, was fixed to the first-named plate, and the other end of the wire, after traversing the electro-magnet, was attached to the other pole of the battery. In order that the current might circulate, it was indispensable that both plates should meet, and from the peculiar arrangement of the two metallic plates, they would always be in contact when the index was at zero (the normal feeding point) or above it, but the contact ceased as soon as the index fell below zero. Let it be supposed that the feed-cock of the force-pump, or other contrivance for supplying water to the boiler, was connected to the spindle of the ratchet wheel: it would follow that the cock must partake of the movement of the wheel, and that it will make a quarter of a turn in one direction when the electric current circulated, and a quarter of a turn in the other when the current was interrupted; thus, the automaton regulator, which was sensitive to the smallest alteration in the water level of the boiler, was perpetually and inevitably maintaining it at a constant height, and thus one great source of danger was obviated. As an extra security, however, against accident by explosion, a minor contrivance was affixed to the same apparatus, and owed its action to similar principles. On the side of one of the levers was fastened a cap, with a gudgeon in its centre. An armature, resembling that already described, was carried by this cap and rested on the gudgeon. In connection with this second armature was placed an electro-magnet, against which it was made to slide and press constantly upon the poles. It was still the index of the water gauge, which induced the circulation, or effected the interruption, of the electric current; and the same electric pile or battery, composed of a single element, or Daniel's pair, sufficed to put in motion the two electro-magnets. The electric wire which proceeded from one of the poles of the battery, and was affixed to the brass plate on the lever of the index, served for the two electro-magnets also. The returning wire corresponding with that about to be described, however, was fixed to a third brass plate, and, after traversing the electro-magnet, was attached to the second pole of the battery. The last-mentioned plate was arranged in such a manner as to establish a metallic contact, which permitted the electric current to pass, notwithstanding the variation in the level of the water to the extent of an inch above or below its

proper line. If the variation exceeded these limits, the current would be forcibly broken. When the electric current was in circulation—that is to say, when the lever was between the limits of variation named—the armature would be suspended by the adhesion of the second electro-magnet; but if the level rose or fell beyond those points, the armature, from the current being broken, must fall. In either case, a small tappet, fixed to the armature below the gudgeon, touches an alarm lever, and thus rings a bell. This arrangement is also serviceable in other respects. The alarm bell rings—when the feed-pump is out of order; when the electric pile ceases to act; if the stoker neglects the fire; or if steam is generated too rapidly. The reader proceeded to point out the application of the “*embrayage électrique*” to the prevention of railway accidents, by connecting it with brakes upon the wheels of the engines and carriages, and certainly gave some very practical illustrations of its value and efficacy in this respect. In France it is extensively used, and testimonials in its favour from many eminent scientific men were submitted to the meeting. Mr. Gettliffe also gave the meeting a further opportunity of judging of its characteristics by exhibiting the apparatus.

On the conclusion of the paper, a short discussion arose; and in this Messrs. Jones, Ives, and Bragg took part. In reply to questions put by these gentlemen, the reader stated, that at the works of Mr. Cater, engineer, &c., Grove, Southwark, an apparatus of the kind he had attempted to describe, might be seen in daily action; as also at Messrs. Simpson's, in Little Britain, City.

## Provisional Protections Granted.

[Cases in which a Full Specification has been deposited.]

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| <p>2009. Samuel Russel Wilmot, of Brooklyn, New York, U.S.A., impts. in hand trucks,—a communication. —August 14th.</p> <p>2020. Pierre François Louis Bienvaux Him, of Le Cateau, France, a water-proof preparation to make fabrics, thread, textile matters, &amp;c., impene-trable against water.—August 15th.</p> <p>2102. John Walter Friend, of Free-mantle, Southampton, impts. in the construction of gas meters, and in apparatus to be employed in connec-</p> | <p>tion therewith for regulating the pressure and flow of gas to the same. —August 26th.</p> <p>2179. Henri Adrien Bonneville, of Paris, impd. mode of attaching horses to carriages or other vehicles, and apparatus therefor,—a communication.</p> <p>2180. Henri Adrien Bonneville, of Paris, impd. machine for glossing and glazing all kinds of threads,—a communication.</p> <p><i>The above bear date September 3rd.</i></p> |
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[Cases in which a Provisional Specification has been deposited.]

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| <p>1158. Charles Frederick Bielefeld, of Gower-street, impts. in the manu-facture of sheets, slabs, and other articles when fibrous materials are employed.—May 8th.</p> <p>1549. George Brixey, of Maida-hill, impts. in apparatus and implements</p> | <p>for cleaning spoons and forks.—June 20th.</p> <p>1614. Thomas Dunn, of the Windsor-bridge Iron Works, near Manchester, impts. in the construction and main-tenance of the permanent way of railways.</p> |
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1615. George Clark, of Craven-street, Strand, impts. in the construction of guns and projectiles, and of carriages, platforms, and shields for working and protecting guns.

*The above bear date June 27th.*

1778. Hypolite Mège, of Paris, impts. in the mode of treating fatty bodies.—*July 16th.*

1821. Carl Heinrich Roeckner, of Richmond-terrace, Clapham-road, impts. in machinery and process for reducing wood to a fibrous condition for the manufacture of paper stuff or pulp.—*July 21st.*

1833. James Ronald, of Liverpool, impts. in apparatus for dressing or preparing for spinning hemp, flax, manilla-hemp, and other like fibrous materials.

1834. Charles Senior, of Dead Waters, near Huddersfield, impts. in means or apparatus for closing, punching, and rivetting hose-pipes of leather or other substances; applicable also for punching and rivetting mill-bands or driving straps, and similar purposes.—*July 22nd.*

1835. Joseph White, of Trinity-street, Trinity-square, Surrey, impts. in pyramid and other cans or feeders for oil and other liquids.

1836. Charles Beslay, of Paris, impts. in making all woven and thready fabrics waterproof, and in finishing or surfacing fabrics generally,—a communication.

1838. Isaac Perrin, of Birmingham, impd. danger signal to be used on rifle, artillery, and other practising grounds.

1839. Joseph Simmons, of Rainham, Kent, impts. in ploughs.

*The above bear date July 22nd.*

1840. William Cole, of Wentworth-road, Bow-road, impts. in apparatus for securing the safety of persons in window cleaning, or otherwise working outside of windows.

1841. Andrew Taylor Holden, of Birmingham, impts. in carriage and other springs.

1842. Louis Laurent Jacques Fillion, of Paris, impts. in apparatus for extinguishing chimney fires, and in preventing explosions.

1843. Matthew Augustus Soul, of Leadenhall-street, impts. in expelling solid and liquid refuse matter from steam and sailing ships below the water-line; applicable also for discharging cannon below water from ships and forts, and in part for charging gas retorts and iron furnaces, and for other similar useful purposes,—a communication.

1844. George Davies, of Serle-street, impt. in revolving fire-arms,—a communication.

1845. William Garforth and James Garforth, of Dukinfield, impts. in preparing, beetling, or finishing textile fabrics, such as cotton, wool, linen, or other fibrous materials.

1847. William Horton, of Glasgow, impts. in fire-arms.

1848. William Clark, of Chancery-lane, impts. in saddles,—a communication.

1849. Thomas Perkins, of Hitchin, impts. in horse rakes and hand rakes.

*The above bear date July 23rd.*

1850. John Kirkland, of Liverpool, impts. in apparatus for working hydraulic presses.

1851. William Lawson Barnes, of Knapton, impd. method of breaking the speed of and stopping railway trains, or other locomotive wheeled carriage or carriages, at the same time signalling to the driver, or for using the signal and break separately.

1852. Abraham English, of Hatfield, Herts, impts. in apparatus for securing and protecting horses and other cattle during their transit by rail and other ways, and on board ship.

1853. Thomas Sturgeon, of Belle Sauvage-yard, impts. in chains.

1854. Bernard Birnbaum, of New Broad-street, impts. in gaiters and leggings.

*The above bear date July 24th.*

1855. Thomas Charles Bull and Thomas Morgan, of Weobley, Herefordshire, an apparatus for collecting fruit from trees without injury.

1856. George Henry James, James Marshall James, and Josiah James, of Dyer's-buildings, impts. in the

manufacture of covers for purses, wallets, and pocket books.

1857. Paulin Etienne Gay, of Paris, impts. in boring apparatuses.

1858. John Boyd, of Glasgow, impd. mechanism for forming imitation selvages or longitudinal cords in weaving.

1859. Frederick Tolhausen, of Paris, impts. in the manufacture of gun barrels,—a communication.

1860. Charles Crockford, of Holywell, Flintshire, impts. in the treatment and utilization of certain of the waste products from the manufacture of alkali and bleaching powder, and also from certain smelting operations.

*The above bear date July 25th.*

1861. John Wellington Welch, of Manchester, impts. in sizing and finishing fabrics, and in the machinery or apparatus employed therein.

1862. William Tranter, of Birmingham, impts. in breech-loading and other revolving fire-arms.

1863. Frederick Ford and Lewis Ford, of Gloucester, impts. in the manufacture of various articles with surfaces in imitation of different kinds of marbles or similar ornamental materials.

1864. Thomas Thorne, of Southsea, Hants, impd. apparatus for disengaging ships' boats.

1865. George Haseltine, of Southampton-buildings, impts. in coal-oil lamps,—a communication.

1866. Richard Archibald Brooman, of Fleet-street, impts. in sleepers or supports for the rails of railways,—a communication.

1867. Joseph Pain, of Spitalfields, impts. in the manufacture of umbrellas and parasols.

1868. James Whittaker, of Walton-le-dale, impts. in engines for obtaining motive power by steam air or any other vapour.

*The above bear date July 27th.*

1870. Maurice Cockerell, of Munden-terrace, Hammersmith, impd. of mortice and other door locks and latches.

1872. Alphonse Anthelme Antoine Baron de Rostaing, of Paris, impd. method of manufacturing iron and

steel with cast iron taken in a sub-divided state.

1873. Douglas Taylor, of Bonchester-bridge, Roxburgh, N. B., impts. in ventilating hay, corn, and other ricks, and in apparatus connected therewith.

1874. John Jewell, of Devoran, near Truro, impts. in setting boilers.

1875. William Thomas Smith, of Dals-ton, impd. method of securing or tightening the cords of blind and other rollers.

*The above bear date July 28th.*

1876. John Sainty, of Burnham Market, Norfolk, impts. in the construction of feeding troughs for sheep and other cattle.

1877. Paul Hyacinthe Girardin, of Paris, impts. in lamps.

1878. Nathan Thompson, of Abbey-gardens, St. John's-wood, impts. in apparatus for stopping the bung holes of casks and similar vessels; also in tools or implements for fixing and removing such stopping apparatus.

1879. George Rickarby and Thomas Albert Barrett, of Oxford, impts. in window frames and sashes.

1880. Henri Adrien Bonneville, of Paris, impd. self-acting "flushing" apparatus,—a communication.

1881. William Edward Newton, of Chancery-lane, impts. in cartridges,—a communication.

1882. Edwin Sturge, of Walworth, impts. in coating or protecting metallic surfaces.

*The above bear date July 29th.*

1883. George Inskeep, of Madeley, Staffordshire, impd. mill for grinding bones, grain, logwood, and such like substances.

1884. John William Branford, of March, Cambridgeshire, impd. agricultural implement for hoeing and cleaning the land, and for cutting or setting out the plants of root crops at certain distances from each other.

1885. Julius Boeddinghaus, of Elberfeld, Prussia, impts. in means or apparatus for the production of printed or parti-colored yarns.

1886. Joseph Thompson Stephens and Charles Hoare, of Bridport, impts. in machinery for the manufacture of



yarns, threads, laid twine, and other cordage.

1888. William Firth and Samuel Firth, of Burley, near Leeds, impts. in machinery and apparatus for working coal and other mines, and in apparatus for loading waggons or other vehicles.
1889. George Smith the younger, of King's-road, Chelsea, impts. in buffing and traction apparatus of railway carriages and waggons.
1890. Richard Hoe, of Leadenhall-street, and Henry James Cole, of New-street, Kennington-road, impts. in fastenings for packing cases.
1891. Thomas Apps, of Lower Norwood, impts. in four-wheeled vehicles.

*The above bear date July 30th.*

1892. William Graham and John Graham, of Burnley, impts. in looms for weaving.
1893. George Sigl, of Vienna, impts. in the construction of force pumps.
1894. John Coope Haddan, of Bessborough-gardens, Piccadilly, impts. in fire-arms and in artillery, and in projectiles for the same.
1895. Joseph Pope Culverwell, of Dublin, impts. in railway lamps.
1896. Jean Baptiste Andreux, of Paris, impts. in the application of steam to toy boats or other similar toys where steam can be employed as a motive power.
1897. Benjamin Johnson, of Church-street, Camberwell-green, impts. in pianofortes.
1898. John Farmerley Dickson, of Bouverie-street, London, impts. in the manufacture of boots and shoes.
1899. Alexander Robertson Arrott, of St. Helens, Lancashire, impts. in bleaching certain vegetable fibres used for textile or other purposes, whether in the raw state or manufactured.

*The above bear date July 31st.*

1901. William Cotton, of Loughborough, impts. in the manufacture of looped fabrics, and in machinery or apparatus employed therein.
1902. Richard Archibald Brooman, of Fleet-street, impts. in dyeing mixed animal and vegetable fibres, whether in a raw or manufactured state,—a communication.

1903. Richard Archibald Brooman, of Fleet-street, impd. warming pan,—a communication.

1904. George Taylor, of Leeds, impts. in shaping boiler and other plates, and in apparatus employed therein.

1905. John Hoeffer, of Manchester, impts. in the method of preparing and treating "codilla fibre" and "tow," to render them available as a substitute for cotton, or to be mixed therewith.

1906. Josiah Kirk, of Burnley, impts. in looms for weaving.

1907. Thomas Bradshaw, of Bolton, Lancashire, impts. in machinery or apparatus for giving motion to "Dobby horses," "flying and swinging boats," or similar apparatus used for public amusement.

1908. Richard Edwin Bibby, of Manchester, impd. fire-proof cement, which may be employed for covering walls, ceilings, and floors, and is also applicable in the manufacture of fire-bricks, crucibles, retorts, melting pots, and for other purposes where fire-resisting properties are required.

*The above bear date August 1st.*

1909. Edmund Sutton, of South Hackney, impts. in fastenings for cigar cases, porte-monnaies, bags, and other like articles.

1910. Thomas Fellowes and Henry Hemfrey, of Spalding, impts. in apparatus for elevating straw and other agricultural produce.

1911. James Engleburtt Vanner, of Coleman-street, impts. in the manufacture of umbrellas and parasols.

*The above bear date August 1st.*

1912. Edward Alfred Cowper, of Great George-street, Westminster, impts. in self-acting mules for spinning.

1913. John William Parker Field, of High Holborn, impts. in the manufacture of sheaths or cases for staves or other similar weapons.

1914. Balthasar Wilhelm Gerland, of Macclesfield, impts. in the manufacture of size, glue, and phosphates.

1915. Joseph Imbert Prosper Bonnet and Jean Pfister, of Paris, impts. in lamps.

1916. Hamilton Woods, of Burton-

upon-Trent, impts. in the apparatus used for regulating the temperatures during the process of fermentation in the "union cask," "tunning cask," or "cleansing cask."

1917. John Munro, of Melton-street, Euston-square, impts. in apparatus for producing optical illusions.

*The above bear date August 3rd.*

1919. Joseph Abrahams, of Gt. Prescott-street, Goodman's-fields, impts. in brakes for railway and other carriages.

1920. Thomas Hutchinson Baylis, of Mornington-road, Regent's-park, impts. in hawse pipes, mooring pipes, and deck chain pipes.

1921. George Stevens, of Portland-place, Clapham-road, impts. in means or apparatus for effecting a regular supply of air or aeriform fluids for various purposes.

1922. Samuel Bury and John Price, of Manchester, impts. in valves for steam engines.

1923. John Henry Walsh, of Kensington, impts. in breech-loading fire-arms, and in the means of extracting cartridge cases therefrom.

1925. William Edward Newton, of Chancery-lane, impts. in machinery or apparatus for moulding and casting hollow projectiles,—a communication.

1926. Edmund Pace, of Queen-street, London, impts. in machinery for cutting splints for matches, and for collecting the same.

1927. Thomas Pickersgill, of Huddersfield, impts. in machinery or apparatus for feeding wool, cotton, and other fibrous materials into machines for preparing the same for spinning.

*The above bear date August 4th.*

1928. Edward Alfred Cowper, of Great George-street, Westminster, impts. in furnaces for heating air, steam, and other elastic fluids.

1929. George Clark, of Craven-street, Strand, impts. in the construction and protection of ships, vessels, and floating batteries, and in the preparation and arrangement of materials for those purposes, some of such impts. being applicable to the construction and protection of land fortifications.

1930. George Wilkins, of Birmingham,

new and impd. means of railway signalling.

1931. William Storer and John Hancock, of Nottingham, for impts. in electro motive engines.

1932. Charles Garton, of Bristol, and Thomas Hill, of Southampton, impts. in evaporating and cooling.

1933. William Hodson, of Hull, impts. in machinery used for propelling carriages and vessels.

1934. Alfred Vincent Newton, of Chancery-lane, impd. mode of, and apparatus for, producing stereotype plates,—a communication.

*The above bear date August 5th.*

1935. George Gowland, of Liverpool, impts. in mariners' compasses.

1936. Charles Lowe, of South Bradford, near Manchester, impts. in dyeing and printing.

1937. Joseph Emerson Dowson, of Victoria-street, Westminster, application of rolled metal plates to the formation of roadways, bridges, tramways, and other structures.

1938. Joseph Gustave Pinède, of Liancourt, Oise, France, impts. in apparatus for regulating the speed of steam and hydraulic engines.

1939. William Proder Hodgson, of Hylton, near Sunderland, and John Vaux Woodfield, of Sunderland, impts. in machinery for the manufacture of rivets.

1940. John Tenwick, of Portsmouth, impts. in self-acting valves and traps for sewers.

1941. James Young, of Bucklersbury, impts. in the preservation of animal matter.

1942. William Clark, of Chancery-lane, impts. in ovens,—a communication.

1943. William Clark, of Chancery-lane, impts. in taps or stopcock apparatus,—a communication.

1944. Gabriel Emile Chargeat, of Paris, impts. in the construction of frames for umbrellas and parasols.

1945. Eugène Ehrenfried Quelle, of Bermondsey, impts. in inkstands.

1946. John Kirkham, of Euston-road, impd. apparatus for generating heat for smelting and other purposes.

1947. Thomas Simmel Kiar, of Blackrock, Ireland, and John Ibbetson Spicer, of Old Ford, Middlesex,

impd. composition for coating or painting the bottoms of ships or vessels, to prevent them from fouling.

*The above bear date August 6th.*

1949. William Jones, of Warrington, impts. in steam boilers.

1951. Alfred Vincent Newton, of Chancery-lane, impt. in the manufacture of shuttles,—a communication.

1952. John William Slater, of Huddersfield, impts. in the production of yellow and orange coloring matters.

1953. John Henry Johnson, of Lincoln's-inn-fields, impts. in apparatus for preventing sea sickness,—a communication.

1954. Richard Archibald Brooman, of Fleet-street, impts. in coke ovens,—a communication.

1955. Edward Watson, of King-street, London, impd. apparatus whereby screw propellers may be made to steer as well as propel; applicable also as an impd. ball and socket joint.

1956. James Platt, of Charlotte-street, Bloomsbury, impts. in apparatus for supplying steam boilers with water.

1957. Thomas Walker Guilloid, of Park - place - terrace, Puddington, impts. in the manufacture of chess-boards and chessmen.

1958. Edmund Morewood, of Stratford, Essex, impts. in coating metals.

1959. John Thompson, Edward Gerard Fitton, and Frederick Alexander Fitton, of Ardwick, Lancashire, impts. in engines for carding cotton and other fibrous materials.

*The above bear date August 7th.*

1960. Nedrick Jarvie and William Miller, of Glasgow, impts. in the manufacture of oakum, and in apparatus therefor.

1961. William Burnet Robins, of Harborne, Staffordshire, impd. instrument or apparatus for extinguishing fires.

1962. John Thornton, James Thornton, Albert Thornton, and William Thornton, of Nottingham, impts. in apparatus used for producing looped fabrics.

1963. Astley Paston Price, of Lincoln's-inn-fields, impts. in the application of India-rubber and gutta-percha to the manufacture of brushes and mats,—a communication.

1964. Henry Rowland Brown, of Cranbourne-street, impd. apparatus for the regulated delivery of cards, tickets, labels, bills, and sheets or pieces of cardboard, paper, metal, or other material for advertising or other purposes.

1965. Michael Smith, of Fleet-street, impts. in obtaining farinaceous material from potatoes.

1966. John Ward Armstrong, of Carmarthen, impts. in fastening and in securing in position the rails of railways, the said fastening being applicable for other uses.

*The above bear date August 8th.*

1967. John Alexander Fullarton, of Manchester, impts. in the method of fastening hoops for packing bales, and in the machinery or apparatus employed therein.

1968. Patricio Marcos del Rio, of Jermyn-street, machine for obtaining motive power.

1969. Bernard Heyne the younger, of Liscard, Cheshire, impd. apparatus to facilitate sketching and drawing landscapes, buildings, machinery, and other objects in correct perspective.

1970. Richard Dickson, of London-wall, impts. in lithographic printing presses.

1971. Richard John Cunnack, of Helston, Cornwall, impts. in the manufacture of cartridges for blasting and projectile purposes.

1972. Alfred Vincent Newton, of Chancery-lane, impd. manufacture of blue and of violet coloring matter,—a communication.

*The above bear date August 10th.*

1973. James Robson, jun., of South Shields, impts. in money tills.

1974. Edward Seigmund Simon, of Bury-street, London, impd. fastening for leggings.

1975. Edward Myers, of Millbank-row, Middlesex, and Hugh Forbes, of Aberdeen-place, Maida-hill, impd. rotary pump.

1976. William Bowles and Robert Halliwell, of Bolton, impts. in machinery for preparing, spinning, and doubling cotton and other fibrous substances.

1977. David Wright Barker, of Anderlecht, near Brussels, impts. in means or apparatus for actuating rotary shuttle boxes.

1978. John Thomson King, of Liverpool, impts. in apparatus for containing and distributing gas for lighting railway carriages, steam boats, and other moveable vehicles, and vessels, railway stations, and other places; parts of such apparatus being suitable for governing the supply of gas and air for various purposes.

1979. William Blackett Haigh, of Oldham, impd. equilibrium saw frame.

1980. Alfred Vincent Newton, of Chancery-lane, impd. process for hardening cast iron,—a communication.

1981. Jacob Geoghegan Willans, of Westbourne-grove-terrace, impts. in the manufacture of iron.

1982. William Clark, of Chancery-lane, impts. in road-sweeping machines,—a communication.

1983. James Wheeler, of the Poultry, London, impts. in the perfuming of gloves.

1984. William Gray, of Brownrigg, Haddington, N.B., impts. in certain parts of reaping machines, and in the working or application of the same.

1985. Sir John Scott Lillie, of Pall-mall, impd. revolving battery.

*The above bear date August 11th.*

1986. George Graham, of Dalquhurn Dye Works, Dumbartonshire, impts. relating to baths or boilers used in dyeing.

1987. Robert Mushet, of Coleford, impts. in the manufacture of cast steel.

1988. John Cornforth and Alfred Andrews, of Birmingham, impts. in nails commonly called screw rivets; which impts. are also applicable to other nails and spikes.

1990. Richard Canham, of Clerkenwell, impts. in machines for the preparation of moulds for casting.

1991. James Templeman, of Glasgow,

impts. in the manufacture or production of artificial fuel.

1992. Robert Stirling Newall, of Gateshead, impd. mode of, and apparatus for, drying chemical compounds and other substances.

1994. William Hudson, Christopher Catlow, and John Dodgeon, of Burnley, impts. in looms for weaving.

1996. William Clark, of Chancery-lane, impd. lamp for burning coal oil and other similar hydro-carbons without the aid of a draught chimney,—a communication.

*The above bear date August 12th.*

1997. John Ellis, of Liverpool, impts. in machinery for scouring, cleaning, and polishing wheat, rice, malt, grain, and other seeds.

1999. Henry Winchcomb, of Chinawalk, Lambeth, impts. in street pillar letter boxes and bags for the reception of post letters.

2000. James Edmunds, of Birmingham, impts. in gun and pistol furniture.

2001. Thomas Ashwin, of Birmingham, impd. dress fastening, which said fastening may also be applied to the fastening of braces, belts, and other bands, and to other like purposes.

2003. John Henderson, of Bradford, Yorkshire, impts. in preparing yarns for printing.

2004. Marc Antoine François Menons, of Paris, impts. in the construction of numbering machines,—a communication.

2006. Harvey Brown, of New York, impts. in burners for lamps for burning oils or fluids.

*The above bear date August 13th.*

2007. Andrew Edmund Brae, of Leeds, impd. means of conducting electric currents through railway trains, and of actuating signals or alarms therein.

2008. Christian Schiele, of Manchester, impts. in fans, pumps, and machinery for propelling air, fluids, or other substances by centrifugal force.

2010. Robert Benjamin Greenwood, of Hackney-road, impd. means of preventing accidents upon railways.

2011. Edward Taylor, of Salford, impts.

- in machinery or apparatus for churning.
2012. Edward Brown Wilson, of Parliament-street, impts. in blast furnaces.
2013. Frederick John Jones, of Aldermanbury, impts. in locks or fastenings.
2014. Matthew Hodgson Lishman, of Stockton-on-Tees, impts. in machinery for punching, and for marking plates in which holes are to be punched.
2015. Michel Siegrist, of Ewell, impts. in railway breaks actuated by the pressure of the atmosphere.
2016. Norman Scott Russell, of Great George-street, Westminster, impts. in apparatus for working great guns.
2017. John Wain, of Manchester, impts. in machinery or apparatus for doubling or twisting yarns or threads of cotton and other fibrous materials.
2018. William Asbury, of Birmingham, impts. in axles and axle boxes, and the parts of wheels immediately connected therewith.
- The above bear date August 14th.*
2019. John William Hoffman, of Rydon-street, impts. in apparatus for producing optical illusions for stage effect in theatres or exhibitions.
2021. George Yates, of Oswaldtwistle, impd. method of, and apparatus for, indicating the number of tubs or other measures or quantities of coal or other substance or material drawn from pits or mines.
2022. George Davies, of Serle-street, impts. in furnaces for heating, flattening, and annealing glass,—a communication.
2023. Edward Scott, of Manchester, impts. in apparatus for governing or regulating the speed of engines,—a communication.
2024. Robert Parker, of Atherton, Lancashire, impts. in "presser flyers" to be employed in preparing, spinning, and doubling cotton and other fibrous materials.
2025. Robert Smith, of Manchester, and Jabez Booth, of Gorton, near Manchester, impts. in the manufacture of paper hangings,
2026. Edward Lord, of Todmorden, impts. in machinery for preparing, spinning, and doubling cotton and other fibrous substances.
2027. Frederick Flavell, of Welton, near Daventry, impts. in shakers for thrashing machines.
2028. Johann Ernst Friedrich Lüdeke, of Elizabeth-terrace, Islington, impts. in the means of keeping cameras or other apparatus steady when suspended to balloons.
2029. Thomas Brooks, of Long-lane, Bermondsey, impts. in means or apparatus for the production of charcoal and other products from refuse, tan, and other woody substances.
2031. Alfred Vincent Newton, of Chancery-lane, impd. apparatus for printing,—a communication.
2032. Roger Lightbown, of Over Darwen, impts. in looms for weaving.
2033. Edward Hammond Bentall, of Heybridge, Essex, impd. machinery for thrashing corn and other grain or seeds.
2034. George Tomlinson Bousfield, of Loughborough-park, Brixton, impts. in the manufacture of cement,—a communication.
2035. Augustus William Parker, of Bristol, impts. in the manufacture of soap.
- The above bear date August 15th.*
2036. John Smith, of Manchester, impts. in machinery for finishing woven fabrics.
2037. Allen Michael Dearn, of Colchester, centrifugal disc mashing machine.
2038. Henri Adrien Bonneville, of Paris, impts. in engraving,—a communication.
2039. Henri Adrien Bonneville, of Paris, impts. in the processes and preparations employed in spinning wool,—a communication.
2040. William Longbottom, of Barnsley, Yorkshire, impd. lubricator.
2042. Thomas Loftus, of Preston, impts. in apparatus for attaching to steam boilers and flues for the consumption of smoke.
2043. James Stead Crosland, of Ashton-under-Lyne, impts. in lubricating, and in arrangements and mechanism

for lubricating the bearings, journals, or steps of spindles, shafts, axles, and other mechanism.

*The above bear date August 17th.*

2044. James Broadley, of Saltaire, near Bradford, impts. in means or apparatus employed in weaving.

2045. Joseph Arthur, of Robert-terrace, Chelsea, impd. apparatus for the prevention, cure, and relief of hernia of every description, together with prolapsus uteri, uterine hemorrhage, hernia, humoralis, and as a general support for enlargement of the abdomen from whatever cause proceeding.

2046. John Briggs, of Blackley, Lancashire, impts. in coating or covering crinoline steel.

2047. John Brennand, of Burnley, impd. construction of fire-bars and apparatus connected therewith.

2048. Henry Robinson, of Skipton, Yorkshire, impts. in lime-kilns.

2049. Thomas Dobb, of Rotherham, impts. in chimney tops, which improvements are also applicable to coverings for ventilating shafts or flues from mines and other places.

2050. Alexander Cruickshank, of Glenpark, Lanarkshire, impts. in the manufacture or production of food for cattle and all other domestic animals, poultry, and game, and in the machinery or apparatus employed therein.

2051. James Yates, of Rotherham, impts. in the manufacture and fitting or securing of armour plates, blocks, or bars, and in the machinery or apparatus employed therein; parts of which improvements are applicable to heavy forgings generally.

2052. Richard Archibald Brooman, of Fleet-street, impts. in the manufacture of hats, caps, and bonnets, and in apparatus employed therein,—a communication.

2053. Richard Archibald Brooman, of Fleet-street, impd. method of, and apparatus for, treating molasses, syrups, saccharine juices, and other products,—a communication.

2054. Jean Baptiste Vincent Faure, of Aschaffenburg, Bavaria, impts. in pen and ink holders.

2056. Cyrus Hall McCormick, of Chi-

cago, U.S.A., impts. in reaping machines.

*The above bear date August 18th.*

2057. William Jackson, of Spring-terrace, York-road, Lambeth, impd. arrangements of the parts in sewing machines for using shoemakers' wax thread, suitable for heavy boot or other leather work to which it may be applied.

2058. Charles Sonnhammer, of Regent-street, impd. fan.

2059. Thomas Howard, of Hyde, Cheshire, impts. in machinery for spinning cotton, flax, wool, silk, and other fibrous substances.

2060. Thomas Scott, of Nelson-square, impts. in the construction of floating docks, or apparatus for lifting ships and other bodies.

2061. George Tomlinson Bousfield, of Loughborough-park, Brixton, impts. in apparatus for feeding weft in hair-cloth looms,—a communication.

2062. Simon Sanderson, of High-street, Shoreditch, impd. fastening for leggings, stays, or other articles.

2063. Gaetano Bonelli, of Turin, and Henry Cook, of Gloucester-square, impd. mode of, and apparatus for, producing, by the aid of photography, optical illusions of moving animals and bodies.

2064. Richard Hughes Jackson, of Leeds, impts. in machinery for sawing wood and other fibrous substances.

*The above bear date August 19th.*

2065. George Spencer, of Cannon-street West, impd. solutions to be used in the manufacture of paints and the preservation of wood, stone, and metallic surfaces, and in the preservation and waterproofing of fibrous materials generally,—a communication.

2066. William Galloway and John Galloway, of Manchester, impts. in steam boilers, and in steam and water gauges for the same.

2067. Samuel Hallsworth, of Elland, near Halifax, and Thomas Platt, of Fairfield, near Manchester, impts. in the manufacture of certain coloring matters, known as Prussian blue,

Berlin blue, Paris blue, China blue, and Turnbull's blue.

2068. William Hamilton, of Brighton, impts. in the manufacture of spring mattresses.

2069. James Fleming, of Newlands-fields, Renfrewshire, N.B., impts. in preserving the colors of dyed fabrics.

2070. John Platt and William Richardson, of Oldham, impts. in machinery or apparatus for cleaning cotton and wool from seeds, burrs, or other such extraneous matters.

2071. John Platt and William Richardson, of Oldham, impts. in machinery or apparatus for winding narrow laps of wool.

2072. William Edward Newton, of Chancery-lane, impts. in the manufacture of cartridges,—a communication.

2073. Charles Daniel Hammond, of Charlotte-street, Bedford-square, impts. in apparatus for the treatment of certain bodily ailments.

*The above bear date August 20th.*

2074. James France Hill, of Little St. Andrew-street, impd. ventilating gas lamp or gasalier.

2075. James Eccleston, of Manchester, impts. in apparatus for economizing or regulating water power used for blowing organs or harmoniums; which improvements are also applicable for other purposes where an irregular motive power is desired.

2076. Thomas Frederick Cashin, of Sheffield, impd. means of communication between the passengers, guard, and driver of a railway train in motion.

2077. Robert Thompson, of New Charlton, Kent, impts. in machinery for planing curved, curvilinear, irregular, and other forms, in iron, steel, and other metals.

2078. Richard Archibald Brooman, of Fleet-street, impts. in expressing and filtering oil from seeds, and liquids from other substances containing the same, and in apparatus employed therein,—a communication.

2079. William Evans, of Belgrave-street, Commercial-road East, impd. artificial fuel.

2080. Robert Griffiths, of Mornington-road, Regent's-park, impts. in the construction of retorts or ovens for

extracting oil from certain descriptions of cannel coal or other bituminous substances.

2081. Edmond Pope, of Clonmel, Ireland, impts. in breech-loading fire-arms.

2082. Jean Baptiste Charles Lange, of Paris, impd. apparatus for indicating or registering the speed or distance travelled by all kinds of vehicles; which said apparatus is also applicable to engines, waterwheels, and prime motors of any description.

*The above bear date August 21st.*

2083. Thomas Pegram, of Cardington-street, St. Pancras, plate holder for the photographic camera, adapted to carry different sized plates, each plate being on the same plane and in the same focus.

2084. Richard Archibald Brooman, of Fleet-street, impts. in closing powder canisters and other vessels,—a communication.

2085. Alfred Watson, of King-street, impd. method of, and apparatus for, inserting pictures in, and withdrawing them from, photographic albums.

2086. Richard Archibald Brooman, of Fleet-street, new metallic alloy,—a communication.

2087. Louis Emile Constant Martin, of Albion-street, Hyde-park, impts. in apparatus for heating and purifying water.

2088. Siegmund Moore, of Liverpool-street, Bishopsgate-street, impts. in the means of, and apparatus for, electro-plating; said apparatus being also applicable to medical purposes.

2090. William Benson and Peter William Greenwood, of Leeds, impts. in preparing and spinning wool and other similar fibres.

*The above bear date August 22nd.*

2092. Alfred Jobson, of Darlington, impts. in machinery for drawing or discharging coke ovens and loading coke waggons.

2094. Claude Sosthène Grasset, of Cyprus, impd. double MacCarty gin, or machinery used for cleaning cotton from its seeds.

2095. Ange Capello, of Marseilles, impd. method of, and apparatus for, glazing morocco leather.

2097. Henry Frederick McKillop, of

- Belvedere, Kent, impts. in cleansing ships' bottoms.
2098. Richard Archibald Brooman, of Fleet-street, impts. in air and gas engines,—a communication.  
*The above bear date August 24th.*
2099. Alexander Hett, of London, and Frederick William Basset, of Camberwell, impts. in preserving animal substances, and animal and other substances used for food.
2100. George Edward Lewis, Henry Walker, and Joseph Blount Wayne, of Birmingham, impts. in breech-loading fire-arms.
2101. William Edward Gedge, of Welington-street, impts. in machinery or apparatus to be used in the manufacture of candles,—a communication.  
*The above bear date August 25th.*
2104. Thomas Hopkins, jun., of White Hart-place, Kennington-cross, impts. in carriage door handles.
2105. Joshua Taylor, of Gomersall, near Leeds, impts. in the manufacture of soap,—a communication.
2106. Jacques Louis Kessler, of Paris, impts. in apparatus for evaporating and distilling.
2107. Santini Fattorini, of Paris, a new division of time, and the application thereof to mathematical and other instruments.
2108. Theophilus Westhorp, of Bromley, Middlesex, impts. in machinery or apparatus for preparing cut rope strands or yarn for carding into oakum.
2109. Richard Johnson and George Bedson, of Manchester, impts. in pointing wire rods or wire, in order to facilitate their introduction into draw plates.
2110. William Edward Newton, of Chancery-lane, impd. apparatus for extracting coal ores or other minerals or substances from mines; which apparatus may be also employed for raising and lowering the workmen and their tools or implements,—a communication.
2111. John Platt and William Richardson, of Oldham, impts. in stoves or grates.
2112. James Fry, of Chesham, impts. in mashing machinery used in making fermented liquors.
2113. David Blake, of Manchester, impts. in shaping and punching metallic articles, and in the machinery or apparatus to be employed therein,—a communication.
2114. John Henry Johnson, of Lincoln's-inn-fields, impts. in obtaining and applying motive power,—a communication.  
*The above bear date August 26th.*
2115. Theodore Bourne, of New York, impd. method of storing and holding petroleum and other oils, naphtha, and other products of distillation containing essential oils,—a communication.
2116. Francis Pragst, of Moscow, impts. in steam engines, and in the mode of utilizing steam.
2117. John Clark, of Glasgow, impts. in break blocks for railway and other carriages, and in the means of applying the same.
2118. James Ward, of Liverpool, impts. in diving apparatus.
2120. William Edward Newton, of Chancery-lane, impts. in breech-loading fire-arms,—a communication.  
*The above bear date August 27th.*
2122. George Davies, of Serle-street, Lincoln's-inn, impts. in the manufacture of iron and steel from the cinders and refuse of puddling and other furnaces, and from certain kinds of ores,—a communication.
2123. Robert Bell, of Glasgow, impd. measuring apparatus for looms.
2124. John Shaw, of Leeds, impts. in machines for cutting or reducing turnips or other roots as food for animals.
2125. Edward Vickers, of Sheffield, impts. in the manufacture of steel.
2126. Edouard Amourous, of South-street, Finsbury, impts. in apparatus for separating solid from fluid fecal matters.
2128. John Alison, of Reigate, impts. in apparatus for tilling land; which impts. are chiefly applicable when steam power is employed.
2129. Charles Harratt, of Highgate, impts. in apparatus for tilling land.



2130. Joseph Walls, of Farington, near Preston, impts. in steam boilers, and in apparatus connected therewith.

*The above bear date August 28th.*

2131. Henry Cholmondeley Pennell, of Weybridge, impts. in the construction of skates.  
 2132. Henry William Putnam, of New York, impd. machine for wringing clothes.  
 2133. George Lowry, of Salford, impts. in and applicable to cotton gins.  
 2134. Thomas Williams, of Manchester, impts. in machinery or apparatus for crushing and flattening the stalks of tobacco and other substances.  
 2135. William Tingey, of Manchester, impts. in printing carpets, piled fabrics, druggets, and other similar articles.  
 2136. Thomas Williams, of Manchester, impts. in machinery or apparatus for steaming and opening cotton and other fibrous materials.  
 2138. David Spiers, Alexander Boyd, and James Kirkwood, of Paisley, impts. in looms for weaving.  
 2139. Arthur Agnew, of Welshpool, impts. in breech-loading fire-arms.  
 2140. Frederick Charles Philip Hoffmann, of Newgate-street, impts. in shears for cutting metal and other substances.  
 2141. Walter Weldon, of Fleet-street, impts. in apparatus for aerial navigation.  
 2142. Alexander Rowand, of Glasgow, impts. in evaporating fluid solutions, and in the machinery, apparatus, or means employed therein.  
 2143. James Dodge, of Waterford, U.S.A., impts. in machinery or apparatus for grinding and polishing metallic articles.  
 2144. Louis Emile Constant Martin, of Albion-street, Hyde-park, impts. in apparatus for generating steam, and for generating gases to be used for heating steam boilers, or for other purposes.

*The above bear date August 29th.*

2146. Henry Edward Kramer, of Leipsic, impts. in printing in colors pictures or devices to be used in ornamenting porcelain, stoneware, earthenware, or any other sub-

stances, where the colors can be annealed or melted, or burnt in.

2147. Francis Augustus Braendlin, of Birmingham, impts. in breech-loading fire-arms.  
 2149. Benjamin Lile Burnett, of Teignmouth, impd. arrangements for removing the fuel from stoves or grates, and for facilitating the extinguishing of the fires used therein.  
 2150. William Edward Gedge, of Wellington-street, Strand, impd. watch, —a communication.  
 2153. John Miles, of Hastings, impts. in traps for catching rats and mice, rabbits, and other animals, and birds.  
 2154. George Brooks Pettit, of Oxford-street, a method of preparing mica and talc, in order to render them applicable to articles of wearing apparel, and to ornamental purposes.  
 2155. Martyn John Roberts, of Crickhowell, Breconshire, impts. in the arrangement or fitting of axles for railway and other carriages.

*The above bear date August 31st.*

2156. Jacob Snider, jun., of Dorset-street, impts. in breech-loading and other ordnance; part of which is applicable to the utilizing of old smooth-bore cannon, and in projectiles to be used therewith.  
 2157. Christopher Shorrocks and William Shorrocks, of Over Darwen, impts. in looms for weaving.  
 2158. George Russell, of Glasgow, impts. in apparatus for cooking and for obtaining fresh water, for use on shipboard and otherwise.  
 2159. William Clark, of Chancery-lane, impts. in hydraulic apparatus, —a communication.  
 2162. George Tomlinson Bousfield, of Loughborough-park, Brixton, impts. in the manufacture of illuminating gas, —a communication.  
 2163. Theodor Erich, of Newgate-street, impts. in machinery for pressing peat, —a communication.  
 2164. George Whiffen Ewens, of Doris-street East, Kennington-cross, impts. in the manufacture of wadding paper and felted fabrics, and in the preparation of vegetable fibres to be used in such manufactures.

*The above bear date September 1st.*

2166. Joseph Lewis, of Manchester, impts. in machinery or apparatus for preparing and drying clay, and also in machinery to be employed in the manufacture of bricks and tiles.

2170. Charles Harvey Corlett, of Güstrow, in the Grand Duchy of Mecklenburg Schwerin, impts. in valves, taps, or cocks.

*The above bear date September 2nd.*

## New Patents Sealed.

471. Charles Malpas.  
473. H. Kilshaw and T. Elce.  
474. F. J. Manceaux.  
475. E. T. Hughes.  
488. R. A. Brooman.  
490. J. D. Welch and A. P. Welch.  
491. Ralph Martindale.  
492. T. R. Harding.  
493. T. Dickins, A. L. Dickins, and H. Heywood.  
494. John Tatham.  
498. W. & H. Whitehead and H. Barber.  
500. John Hawthorn.  
503. J. W. Burton.  
505. William Hooper.  
507. E. R. Walker.  
510. August Jünger.  
519. R. A. Brooman.  
524. B. Lawrence and W. Niblett.  
527. H. H. Benson.  
531. Nathan Thompson.  
533. Alexander Macivor.  
534. George Tomkins.  
537. Charles Ritchie.  
539. W. A. Wilson and J. Smith.  
541. A. P. Price.  
542. James Yates.  
547. R. J. Nodder.  
549. J. H. Albinson and H. H. Cocker.  
550. Werner Staufen.  
552. E. T. Hughes.  
553. James Carver.  
554. J. A. Coffey.  
557. A. Dudgeon, G. F. L. Meekin, and E. E. Allen.  
560. V. D. Delahaye.  
564. William Hadfield.  
568. Stephen Williamson.  
570. Edward Paine.  
571. T. E. Symonds.  
574. Edward Hayes.  
575. Samuel Bateman.  
577. Owen Murrell.  
580. A. F. Pagny.  
581. G. Hawksley and T. Bissell.  
584. Charles Garton.  
585. J. S. Wells.  
587. T. E. Symonds.  
590. G. F. Lyster.  
593. John Henderson.  
594. G. Price and W. Dawes,

599. B. S. Cohen.  
601. James Pollard.  
602. C. M. Palmer and J. McIntyre.  
603. J. F. Gits.  
606. T. H. Morrell and J. Williamson.  
607. E. A. Wimsch.  
608. Patrick Adie.  
611. William Clark.  
615. William Whittle.  
616. T. E. & R. Thornton.  
617. John Clinton.  
622. W. Jackson and R. Watkins.  
623. S. H. Foster, T. Bunney, and J. Anderson.  
624. John Miller.  
627. John Howie.  
628. William Clark.  
629. Joseph Elsey.  
632. W. H. Buckland.  
634. Alex. Cuthell.  
635. A. W. Makinson.  
639. D. W. Ransom.  
640. Thomas Hancock.  
642. T. G. Webb.  
646. Robert Mushet.  
647. James Cowley.  
648. H. A. Bonneville.  
649. James Isherwood.  
651. C. H. Lea.  
652. William Inglis.  
653. Pierre Hugon.  
655. W. J. Clapp and N. Coats.  
656. J. R. Gorst.  
657. W. E. Newton.  
660. R. T. Monteith and R. Monteith.  
661. Andrew Barclay.  
663. John Cassell.  
665. W. R. Mulley.  
666. Henry Wilson.  
669. Andrew Barclay.  
670. John Werge.  
671. James Tomlinson.  
672. Joseph Renshaw.  
673. William Rosseter.  
674. F. Buser Kraushaar.  
675. H. D. Taylor and J. W. Taylor.  
677. William Clark.  
679. James Polkinghorne.  
680. H. B. Barlow.  
681. J. Harris and J. H. Fraser,  
687. J. H. Johnson.

692. John Page.  
 693. J. W. McCarter.  
 694. Joseph Tangye.  
 695. Robert Alexander.  
 697. William Young.  
 699. James Walworth.  
 702. Felix Hoyos.  
 703. T. W. Willett.  
 706. Thomas Powell.  
 709. W. G. Eavestaff.  
 712. W. H. Atkinson.  
 713. W. E. Gedge.  
 715. John Cox.  
 719. William Symington.  
 720. W. C. Wild and J. H. Randel.  
 721. W. Donbavand and D. Crighton.  
 723. R. A. Brooman.  
 724. F. R. H. Chandler and J. G. Richmond.  
 727. Benjamin Wren.  
 729. Thomas Oldknow.  
 730. Frederick Norrington.  
 732. Auguste Morel.  
 735. Ellis Lever.  
 736. Henry Wilde.  
 737. H. O. Haughton.  
 740. C. Webster and W. Forgie.  
 745. J. Nield and T. A. Nield.  
 746. R. A. Brooman.  
 750. C. Pryse and D. Kirkwood.  
 751. J. Brigham and R. Bickerton.  
 752. Fedor de Wyldé.  
 754. F. and A. Roberts.  
 756. G. A. Biddell.  
 757. E. Hartley, J. Clegg, T. Mellodew, and J. Mellodew.  
 758. J. M. Hetherington.  
 761. William Clark.  
 764. William Johnston.  
 767. William Clark.  
 769. J. Reilly and W. Martin.  
 773. Alfred Joseph and Jabez Topham.  
 778. J. Leach and J. Anderson.  
 779. J. H. Warrell.  
 780. George Stuart.  
 781. Charles Monson.  
 782. R. Armitage and C. Senior.  
 785. R. A. Brooman.  
 787. Louis Christofleau.  
 788. Robert Mushet.  
 789. George Cowdery.  
 790. M. L. Parnell.  
 792. William Johnson.  
 795. George Davies.  
 797. John Norton.  
 801. John Grantham.  
 802. W. M. Morgan.  
 804. J. Taylor, jun.  
 805. William Clark.  
 807. J. King and T. H. Marshall.  
 811. J. Leeming and R. S. Markindale.  
 816. Joseph Musgrave.  
 818. Robert Mushet.  
 821. W. E. Newton.  
 832. Henry Hamer.  
 833. J. M. Dunlop.  
 838. Michael Henry.  
 839. William Clark.  
 842. G. T. Bousfield.  
 848. D. S. Sutherland.  
 881. A. V. Newton.  
 884. Joseph Mosheimer.  
 885. J. N. Brown.  
 886. Thomas Gray.  
 902. A. V. Newton.  
 904. A. V. Newton.  
 905. Gustave Colomb.  
 952. A. V. Newton.  
 1010. W. E. Newton.  
 1035. L. A. J. Bruet.  
 1040. Alexandre Legras.  
 1048. J. J. Robert.  
 1058. Henry Beare.  
 1064. William Clark.  
 1066. J. H. Johnson.  
 1071. George Davies.  
 1180. C. L. Van Tenac.  
 1194. H. L. Emery.  
 1223. William Clark.  
 1252. Ferrar Fenton.  
 1262. Joseph Coignard.  
 1291. A. W. Hofmann.  
 1339. C. E. Laederich.  
 1376. D. Wilson and E. A. Cowper.  
 1390. J. J. McComb.  
 1409. A. J. Hollingsworth.  
 1424. W. E. Newton.  
 1478. George Davies.  
 1513. W. H. Dawes.  
 1574. C. T. Burgess.  
 1594. J. L. Hughes.  
 1602. Robert Mushet.  
 1616. W. and J. Bradshaw.  
 1619. George Davies.  
 1642. Hiram Hutchinson.  
 1643. G. T. Bousfield.  
 1648. Edward Lloyd.  
 1690. G. P. Reed.  
 1693. William Basford.  
 1702. W. E. Newton.  
 1726. R. Hornsby, J. Bonnell, and W. Astbury.  
 1788. A. Montleart and W. Tent.  
 1826. J. E. Vanner.  
 1844. George Davies.  
 1862. William Tranter.

\*\*\* For the full titles of these Patents, the reader is referred to the corresponding numbers in the List of Grants of Provisional Specifications.

# NEWTON'S

## London Journal of Arts and Sciences.

No. CVII. (NEW SERIES), NOVEMBER 1ST, 1863.

### THE COTTON TRADE—ITS PAST STATE AND PROSPECTS.

WHENEVER the domestic affairs of the United Kingdom shall find a fitting historian, not the least remarkable and honourable record will be that showing the manner in which the calamity of the cotton famine was met and successfully encountered. In the absence of such a record, we propose to throw together a few facts, which will indicate the nature and proportions of the calamity from which the cotton trade is now happily emerging, and to direct attention to the means which enabled the operatives to struggle on thus far successfully.

In one respect this has proved a singular exception to the great national trials which have from time to time overtaken us; for, so far from taking us by surprise, the evil was fully anticipated by many thinking men, ably discussed in the public journals, and attempts were even made, though after a feeble fashion, to avert the evil; but it was never imagined that by any act of man we should suffer from a cessation of the American supply of cotton. What, however, a bounteous Providence was still willing to bestow, the wrath of man has wrested from our grasp, and we have now learned the value of that beautiful theory which the objectors to the plan of subsidizing India, with the view of encouraging the growth of cotton, relied on, in defending their neglect of a most obvious precaution, viz., that demand will always create an adequate supply.

It is very difficult to arrive at any correct estimate of the value to this country of the cotton manufactures, or even to estimate their importance relatively to our other industries; yet, without some such statistical information, it is simply impossible to measure the proportions of the calamity which the country has tided over, or to appreciate the severity of the burden which it has had to bear. By means, however, of the statistics obtained by order of the House of Commons, and admirably summarised by Mr. Robert Baker, the very able Inspector of Factories, in a report to the Secretary of State, dated December 16th, 1862, we have at least the means of judging of the capacity of our spinners to consume cotton, and, consequently, of determining the amount required to keep them in full work. Then, by comparing that amount

with the quantity imported and retained for home use, we come to an approximation of the rate of distress which a contracted supply has occasioned. In the year 1860, when the trade was in its most flourishing state, the number of spindles in the United Kingdom had reached the enormous number of 30,387,467, to keep which in regular work—their power of consumption being at the rate of  $9\frac{1}{4}$  oz. of cotton per spindle per week—required, for the year, 1,051,623,380 lbs. of cotton. The importation for the year 1860, we find, was 12,419,096 cwt., and deducting therefrom the amount exported, there remained for home consumption 10,183,126 cwt., or 1,140,510,112 lbs.,—a quantity but slightly in excess of the capacity of our machinery to work it into yarn; although there are other uses to which cotton is applied, as, for example, the manufacture of wadding. By the stoppage of the American supply our imports dropped, in the year 1862, to 4,678,333 cwt., while such was the demand for the raw material on the Continent of Europe, that the rate of export was maintained to within one-seventh of that of the year 1860, thereby reducing the supply for home consumption to 309,258,656 lbs., or considerably less than one-third of the quantity retained in the year 1860. This was not, however, all the evil, for the shortness of the supply enhanced the value of the product, and thus put it out of the power of many manufacturers to continue working at a profit. The rise in the price of cotton consequent on the diminution of the supply to less than one-third, brought the computed real value of the cotton retained in the country for the year 1862, up to considerably more than half that of the supply for 1860,—the value of the cotton retained for 1860 being £30,418,699, and for 1862, £17,584,438. Moreover, the bulk of the imported cotton (Surat) was of such quality that the workpeople, if working full time, would necessarily make some 20 per cent. less wages at the ordinary rates of piece-work, owing to the necessity for slackening the speed of the spindles, to prevent the constant breakage of the yarn.

Now, the number of persons employed in the cotton mills of the United Kingdom, and subjected to the vicissitudes of the cotton market, is, according to a return recently furnished to the House of Commons, 451,569, or, for England, in which the distress was most severe, 407,598. There are, however, many trades more or less closely connected with the cotton manufacture, and which must rise or fall with it; we shall therefore find—on a comparison of the numbers in and out of work, and coming within the cognizance of the Central Executive Committee, whose head quarters are at Manchester, and who undertook the onerous duty of administering the bounty of the nation to the distressed operatives—that the welfare of considerably more than 400,000 persons was intrusted to their hands. The last report

read by the Honorary Secretary of this association (Mr. Maclure), bearing date October 19th, 1862, in contrasting the present state of the trade with the worst period of the present crisis, viz., December, 1862, gave the numbers in full work in the districts in communication with the association, at 121,129; on short time, 165,000; and entirely out of work, 247,230; thus making a total of 533,959 workpeople dependent on the cotton supply. If then, the duty of providing wholly for the necessities of 247,230 workpeople, and the partial support of 165,000 more, was the extent of the burden put on the nation by the cotton famine, that would be no trifle; but it falls very far short of the duty which has been so cheerfully undertaken and faithfully performed. And, first, to understand the meaning of keeping some 120,000 persons in full work, and 165,000 in partial work, while cotton was selling at from 24*d.* to 27*d.* per lb., we must refer to the report, to the Secretary of State, of Mr. Alexander Bedgrave, the Factory Inspector, dated October, 1862. In this report, which forms an admirable exposition of the various means employed in rescuing the operatives from starvation and demoralization—as Mr. Baker's does, of the extent and resources of the textile manufactures of the United Kingdom—we find the following remark:—"There is one method of relief of which it is impossible to estimate the extent—that of keeping a mill at work, either wholly or partially. There can be no doubt that the running of the larger number of mills has for some time past been attended with loss to the manufacturer: it has been, and is, their mode of maintaining their hands. It is well known in the trade, that many of these mills are actually run at a loss, and it is very doubtful whether a mill can be now run without a loss for two, three, or even four, days per week.\* \* \* If the running of a mill during the crisis be, therefore, attended with loss, there are nearly one-half of the cotton manufacturers of Lancashire and Cheshire maintaining and helping to maintain, their hands at the sacrifice of their own property." Again, if we deduct from the total of cotton operatives given above, the number in full work, we shall find but 412,830 requiring eleemosynary aid at the period of severest destitution. Yet in a tabular statement contained in the Central Executive Committee's report, showing the diminution of the amount of indigence, we find the number of persons relieved in January of the present year was 456,786, being an excess of nearly forty-four thousand over the apparent number requiring aid. Indeed, considering, on the one hand, the difficulty of insuring accurate Parliamentary returns relating to industrial pursuits, and, on the other, of estimating the numbers supported by private and unrecorded charity, entirely independent of the rates and the local machinery created for the disbursement of public funds, the impossibility of ever coming to a close reliable estimate, either of the numbers

rescued from starvation, or the cost at which this duty has, up to the present time, been achieved will be apparent. We have, however, at hand ample means of showing how complete was the prostration of trade in certain districts, and how great the labour and responsibility voluntarily undertaken—and that without Government aid—to supply the physical needs and sustain the spirits of the working population. In an admirable report prepared by Mr. Henderson, one of the assistant inspectors of Mr. Redgrave, and embodied in the latter gentleman's report, we find the state of Blackburn vividly portrayed. This town, the census returns of which in ten years had shown an increase of some 50 per cent., early felt the depression of the cotton trade. So early as January, 1862, out of a total number of 21,848 persons, recognised by the chief constable as usually employed in the town, 6252 were working full time, 10,920 short time, and 4676 were totally idle. By the 1st August, when the returns were fuller, out of 26,440 there were 12,099 wholly unemployed, and the remainder about equally divided between full and short time. But, on the 28th of November of the same year, out of 27,273 work-people, only 5713 were engaged full time, 4769 short time, and 16,791 were wholly unemployed. "It was now estimated," says Mr. Henderson, "that the distress in Blackburn had reached a point when fully one-half of the population had to be provided for day by day, and week by week, from the several resources of public and private charity." The weekly loss of wages sustained by the operatives of Blackburn has been calculated at £13,500, and the gross sum since the crisis commenced, at £518,000. Let those who are curious in figures consider what this sum of £13,500, turned over and over, weekly, in the thrifty hands of small shopkeepers, would by this time have produced in the shape of profit, even if that profit were limited to 10 per cent.; and they will then see what those must have suffered whose living depended on supplying the wants of the factory workers. But there is another circumstance, besides the diminished funds of the operatives, that affected the small tradesmen, and that is, the facilities created, through the generosity of large manufacturers, for supplying the necessities of life at wholesale, and even below wholesale, prices. The temptation, therefore, to purchase at these provision stores kept from the retail provision dealers even the scant funds of their former customers.

The plans adopted for ameliorating the condition of the cotton workers were diverse, as were also their sources of support; but unlike other occasions of great national calamity, as the Irish famine, no pecuniary aid was on this afforded by Government. The wealth of Lancashire and Cheshire was considered equal to a very heavy strain, and in no other English counties did the distressed cotton spinners and weavers form a very formidable proportion of the inhabitants. The rates administered

by the boards of guardians were considered as the main stay ; next a national contribution, which, centreing in London, and being under the management of the late Lord Mayor (Alderman Cubitt), may be called the Lord Mayor's fund ; then local subscriptions, headed by, and administered under the advice of, Lord Derby ; and, lastly, private benefactions. What has been the gross expenditure from all these sources we have no means at present of ascertaining, nor is it likely that a reliable estimate can ever be made of the private benefactions ; but there is every reason to believe that the distribution of the funds has been most creditable to all concerned. A thorough understanding seems early to have existed between the London Committee, the Executive Committee (of which Lord Derby was chairman), and the boards of guardians, so that aid afforded by one body was proportioned to the supplementary aid afforded by another. In like manner, when by private beneficence a family was sustained, that family was altogether removed from the books of the relief committee, or their claim upon the public funds was modified accordingly. We find that the subscriptions to the Lord Mayor's fund amounted at the last audit of accounts (15th October) to £510,380. 17s. 5d., which, with accruing interest, now stands at £511,883. 14s. 10d. Of this large sum, £437,099. 15s. 5d. was remitted to the North, and £10,000 appropriated as an emigration fund. This, with a large local subscription, retarded by hoping against hope that the evil was a fleeting one, has enabled the guardians to grapple with the destitution around them. The crude tests of poverty—stone breaking and oakum picking, being totally inapplicable in this case, sewing classes for the girls and schools for the men were established ; certain hours of attendance per week giving them a claim on the funds. A test of this kind has been general throughout the distressed districts, and the results are highly satisfactory.

It will be remembered that when Lancashire distress was the prevailing topic, a great outcry was made against the "cotton lords," who had fattened upon the labour of their operatives, and now left them to the mercy of the public. Mr. Redgrave's report, to which we have already alluded, shows the value of this outcry. On his own knowledge he speaks of one firm whose establishments usually employ above 2000 hands, and who pay all their workpeople, whether unemployed or working only one or two days, three days' wages per week. "Calculating," he says, "as is usual, the average wages of a cotton factory at 10s. per head, this firm has been for some time contributing £500 per week for the support of their hands." A sub-inspector reports thus :— "Scarcely a week elapses but that I come across some quiet unobtrusive act of kindness on the part of masters to their hands, scarcely known beyond the gates of the factory where it originated." It is



due to these gentlemen that we should give some few examples of their liberality:—

“— Mills entirely stopped. Are giving each week at the rate of one day's wage to each of their hands.”

“— Working three days a week. Has been selling bacon at wholesale price to his hands, and is giving them soup every Saturday.”

“— Mills entirely stopped. The most perfect system of relief that I have seen is that in practice at these mills. The proprietors are giving each week at the rate of a day and a-half wages to their hands; and, in addition to this, have opened provision stores within their mills.”

By this arrangement bread, retailed at 6*d.* per 4-lb. loaf, was sold for 4*d.*; bacon for 4*d.* per lb. instead of 7½*d.*; rice at 1½*d.*; tea, coffee, and meal at proportionately low rates. Here is the report of another sub-inspector:—

“Mr. —'s donation of £500 to the Relief Committee was as nothing when compared with his weekly contribution towards the relief of his own hands.”

Then follows a sketch of his doings. Again,

“With equal liberality Mr. — allows the hands in his employ as under:— Children under 13, 2*d.*; and from 13 to 15, 4*d.* per day and school wages. All persons above 15, 8*d.* per day. He has fitted up rooms in his mill for sewing and educational classes,—selecting the teachers for the men's educational class from the overlookers of the various departments in his mill, who are paid from 8*s.* to 10*s.* per week. There are at present 385 men in the adult class; 34 youths, 13 to 15, and 33 children under 13, in the national school; total, 452 males. 442 women in the sewing class; 100 married women who remain at home; 48 girls 13 to 15, and 19 girls under 13 at national schools; total, 609 females. The amount paid to the above each week, as per the above-mentioned scale, is on the average £180, or at the rate of between nine and ten thousand pounds per annum.”

“Mr. — sets a noble example, not only by his contributions, but in the interest he at all times takes in the welfare of those around him. *He has worked full time up to the present moment.*”

These are but samples of what Mr. Redgrave has selected, and we might vary their character, by showing how one master, besides advancing money to support his workmen, continues them in cottages which he rents for their use; while another, not satisfied with distributing bread, potatoe-hash, porridge, and milk, and taking the chairmanship of the Relief Committee, allows his tenants to accumulate a debt of £1000 on the score of unpaid rents. But what has been cited will suffice to show that acts of generosity among masters are not isolated acts, and that, as a class, they have thus far nobly done their duty.

That the condition of the operatives has steadily improved throughout the present year is manifest from a tabular statement in the report of the Central Executive Committee already referred to; for whereas the total number relieved by Guardians and Local Committees in the month of January was 456,786, in September the number was reduced to 184,625. The last published account of the Poor Law Board, dated October 23rd, also goes to confirm this progress—the average weekly expenditure for out-door relief for the year ending Michaelmas, 1863;

being £12,947; whereas, the third week of October shows an outlay of only £8,276. We are, however, reminded by Mr. Edmund Ashworth, in his paper on the *Prospects of the Cotton Supply for 1864 over 1863*, prepared for the Executive Committee, that an increase next year of only 610,000 bales over the limited or half-time supply of 1863, is to be looked for, which will allow of the consumption of 33,730 bales per week, equalling only four and a half days' consumption.

This, though in itself not a very bright prospect, is considered by many as too sanguine a view; at all events it shows the prudence of the step, which has recently been taken, of providing employment for able-bodied operatives upon public works,—an Act passed last session having enabled corporate bodies to borrow money for such works. Emigration must also play a prominent part, unless the flax trade, which has received an unwonted stimulus from the rise of cotton goods, shall be able—which is hardly likely—to absorb the surplus operatives. Already we find this mode of relief has been adopted, for Mr. Oram, one of Mr. Redgrave's assistant inspectors, says:—"It appears that above 1700 persons left the neighbourhood of Ashton-under-Lyne in 1862, for America, Queensland, and British Columbia; and that between the 1st of January and the 25th of April, 1863, above 878 persons have left the same neighbourhood for the United States, Canada, Australia, and New Zealand." We have also seen that £10,000 of the Lord Mayor's Fund has been applied to assist emigration.

For many reasons the present does not appear to be the time to fold our arms, as if the trouble were passed, though our efforts may happily be slackened. On this point Mr. Baker's experience may serve us. He says:—"I know the textile trades well enough, and in my long experience have seen the phases of good and bad times grow so fast, and approximate so closely, by the force of capital, and the productive powers of machinery, that I am aware there is great risk of our running into a sudden belief that this cotton famine has passed away, as did that in 1848, and others which preceded as well as succeeded it." He cautions us neither to be too sanguine as to the re-adjustment of the trade, nor too disappointed at its delay.

As respects the funds yet unexpended, the Central Executive Committee report their balance at the bankers to be £271,513. 14s. 9d.; in Liverpool, £39,355. 17s. 6d.; and the Bridgewater-house Committee, £86,270. 17s.; making in all £397,140. 9s. 3d.; to this must be added £64,622. 2s. 3d., the balance in the hands of the Lord Mayor. These sums, it is believed, will serve, with the aid of local taxation, to continue the present system of relief through the winter, and thus afford time for the much desired redistribution of labour in the factory districts.

We have thus far traced, from authentic records, the nature and extent of the calamity which the American war has brought upon our cotton manufacturers, and we have shown the kind of help which was administered to the sufferers; it only now remains to notice in what spirit this aid has been received. For information on this head, we will again refer to the report of the Factory Inspectors. In closing his report, Mr. Redgrave says:—"In all these lamentable sufferings, one great good at least is even now showing itself,—the mutual appreciation of each other by masters and operatives." And in the same strain Mr. Baker says:—"With the privations which both masters and work-people have suffered, there has also been a sympathy awakened between them, and they have gained a knowledge of one another, which could scarcely have been brought about by any other cause," \* \* \* There has in fact been impressed upon thousands of hearts a living photograph of new ties and fresh relations between master and man, and man and man, and home and home, which, for the want of the opportunity, has hitherto been kept out of sunlight." Let us hope, that with the revival of trade, this bond of sympathy may remain; if so, this national calamity will not have fallen upon us in vain; for besides disabusing us of the popular notion of the iniquitous character of factory labour, it will ensure permanent blessings to the operative classes, thus adding yet another illustration of the truth of the poet's words,—

"One touch of nature makes the whole world kin."

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### Recent Patents.

To JOHN DUCKWORTH, of *Pilkington, near Manchester*, for improvements in the manufacture of paper.—[Dated 11th February, 1863.]

THIS invention consists in mixing with the fibrous pulp commonly used in paper-making a suitable proportion of a grey or slate-colored mineral, found principally in the coal mines of Lancashire and other parts of Great Britain, generally covering the seams of coal. The mineral is principally composed of alumina, common clay, and shale, and is ground or pulped in any suitable manner. By this admixture, the paper is made cheaper, of finer quality, and more susceptible of glaze than by the ordinary modes employed; and various shades of color may be obtained without the aid of other coloring matters.

The patentee claims, "the mixture of the mineral substance generally known by the name of "doughing" (being a mineral found covering the seams of certain mines of coal), with the fibrous pulp or half stuff used in the manufacture of paper."

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*To FRANZ BOECKE, of Berlin, for improvements in sewing or uniting fabrics, and in the machinery or apparatus employed therein.*—[Dated 28th November, 1862.]

THIS invention relates to certain improvements upon what are commonly known as the "Wheeler and Wilson" and the "British" sewing machines, but they are also applicable to other sewing machines of the same character, or where the driving shaft is similarly placed. The bobbin or under thread case or shuttle of the Wheeler and Wilson or the British sewing machine, is constructed with a raised conical or rounded boss or projection in the centre, on that side next which the needle works; a corresponding recess being made in the back of the hook when adapted to the Wheeler and Wilson machine, to receive the projection on the inner side of the bobbin, thread case, or shuttle. By the aid of a thread case or shuttle fitted or formed with this projection, a twisted chain stitch, having a second thread passing through the loops, may be produced in the Wheeler and Wilson or in the British sewing machine; or if desired, the second or under thread may be dispensed with, in which case the machine will produce the twisted chain stitch from a single thread. The object of the projection in the side of the bobbin thread case is to hold each one side of the loop of the needle thread until the point of the needle has passed down in front of it, so that on the thread slipping over the projection, the loop will be round the needle, and consequently round the thread carried by the needle, thus forming the chain stitch. The operation is precisely the same when a second thread is used. In some cases, an outer projecting rim is formed on the same side of the thread case as the projecting boss, and concentric therewith; whereby the boss may be made smaller, as the thread is partially held back by first catching on the edge of the projecting rim, and then slipping off on to the central boss or projection.

In Plate X., fig. 1 represents a front elevation of the Wheeler and Wilson rotating hook, with the improved bobbin thread case or shuttle adapted thereto; fig. 2 is a corresponding longitudinal vertical section of the same; and fig. 3 is a detailed section of the bobbin thread case or shuttle detached and provided with a slightly modified form of central projection. *a*, is the rotating hook, in the central recess of which is placed, in the ordinary manner, the improved shuttle *b*. A projecting boss *c*, is fitted to the centre of this shuttle at the back thereof, or that side next which the needle *d*, operates. The sides of this projecting boss *c*, may be either curved, as shown in fig. 2, or made straight and slightly inclined or tapering, and combined or not with an outer projecting rim *e*, *e*, as in fig. 3. In all cases, however, an additional recess *e*, is formed in the centre of the hook, to admit the boss or projection *c*, and have sufficient clearance for the free passage of the loop of the needle thread. Fig. 1 shows one side of the loop held back by the pressure of the boss *c*, until the needle has descended in front of it; immediately after which the tension or pull on the thread will cause the loop to slip over and pass the boss *c*, leaving the thread round the stem of the needle. If no under thread be used, the stitch produced will be a twisted chain stitch, similar to that shown by the diagram fig. 4; but if a second or locking thread be employed, such thread will be carried through each loop of the chain; the resulting stitch being a locked chain stitch, as shown in fig. 5. If

desired, the revolving hook and the improved thread case or shuttle may be combined with any other type of sewing machine in which the driving shaft is suitably situated, as, for example, in the Willcox and Gibbs' machine.

The patentee claims, "First,—the application and use to and in the discoidal bobbins, thread cases, or shuttles of sewing machines, of a central boss or rim, in the manner and for the purpose described; Second,—the combination of a rotating hook or looper of any suitable form with a discoidal shuttle or thread case having a central raised boss, projection, or rim formed on one side thereof, in the manner and for the purpose described."

*To GEORGE WRIGLEY and SAMUEL MORRIS, both of Dukinfield, Cheshire, for improvements in machines for spinning and doubling.*—[Dated 13th February, 1863.]

THIS invention relates to an improved mode of driving the cam shafts of self-acting mules. It has heretofore been customary in the mules known as Roberts's self-actors, to drive the cam shaft from the twist shaft by means of a friction pulley, in which four recesses are made: it is now proposed to drive the cam shaft by gearing.

In Plate X., fig. 1 is an elevation of part of the headstock of a self-acting mule to which the improvements are applied; and fig. 2 is a plan of the same. *a*, is the ordinary rim shaft of the mule, and *b*, the backing-off wheel, to which is fixed the internal friction pulley fitting on the usual friction cone *c*. *d*, is the cam shaft, to which is fixed the cam *e*, for working the lever of the backing-off wheel *b*, and the escapement disc *f*. The improved arrangement for driving the cam shaft is as follows:—The backing-off wheel *b*, gears into the carrier pinion *g*, which gears into another carrier pinion *h*, gearing into the pinion *i*, loose on the cam shaft *d*. To the boss of the pinion *i*, is fixed the ratchet wheel *j*; this boss passes through the lever or fixing *k*, which is secured to the bracket *l*, in which are rivetted the studs for the carrier pinions *g*, and *h*. To the eye or centre of the lever or fixing *k*, are fixed four projections, the object of which will be explained hereafter. Attached to the cam shaft *d*, is the disc *m*, in which is a stud for the catch *n*, which takes, when required, into the teeth of the ratchet wheel *j*: the catch *n*, is acted upon by the spring *o*, which is also fixed to the disc *m*. The mode of operation is as follows:—The parts are shown in the positions they occupy when the carriage is near the roller beam. As soon as the escapement lever forming part of the mule known as Roberts's self-actor, has liberated the escapement disc *f*, the usual cam spring acting on one of the studs projecting from the back of the escapement disc *f*, moves the cam shaft round for a very small portion of a revolution, or sufficiently to release the catch *n*, from the projection on the boss of the lever or fixing *k*, on which it is now shown; the catch *n*, then drops into gear with the ratchet wheel *j*; the backing-off wheel *b*, then gives motion to the pinion *i*, (through the carrier pinions *g*, and *h*,) and ratchet wheel *j*, which, acting on the catch *n*, causes the disc *m*, and cam shaft *d*, to make one-fourth of a revolution, or until the catch *n*, is lifted out of gear with the ratchet wheel *j*, by the projection *k'*, of the lever *k*. The successive changes in the position of the cam shaft are performed in a similar manner,—each quarter revolution bringing the

catch *n*, on one of the four projections on the boss of the lever *k*. If it should be requisite to change the position of the cam shaft by hand, the operative, acting on the sliding bar *p*, draws the pinion *h*, out of gear with the pinion *i*, thus setting the cam shaft at liberty. The improvements may be modified by connecting the lever *k*, with the four projections, above referred to, to a vertical rod bearing upon a horizontal bar with three inclines. When the carriage is out, and the first change is required, the horizontal bar is liberated by a stud on the carriage lifting a catch; the second change is performed by the twist finger liberating the bar; the third is performed by the locking of the faller; and the fourth, when the carriage is in, by an incline on the carriage raising the vertical rod above referred to. At every change, the lever is moved to liberate the catch *n*, on the disc *m*, thereby allowing it to drop into gear with the ratchet wheel *j*. The cam shaft *d*, is held in position after every change by a spring taking into notches in a disc.

The patentees claim, "the improved mode of driving the cam shaft by toothed gearing, and the arrangement of parts for connecting and disconnecting the pinion *i*, to and from the cam shaft, as shown and described."

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To THOMAS MARKLAND, of *Hyde, Cheshire*, and JOHN CHARLES DICKINSON, of *Blackburn, Lancashire*, for certain improvements in machinery or apparatus for warping or beaming yarns or threads.—  
[Dated 19th February, 1863.]

THIS invention is designed for the purpose of stopping the mechanism employed in the process of warping and beaming when any of the threads become disunited. The improvements consist in a novel apparatus for effecting this purpose, which may be described as follows:—Between the ordinary rollers and the warping beam a series of "dents" are arranged, which are secured in elastic material so as to be contracted or expanded as required; these dents are employed to serve as guides for fingers or levers under which the yarn passes from the rollers to the beam,—the said yarn on its progress passing underneath a cranked or bent portion of the yarn guides, thus keeping them, by the tension of the yarn, in an elevated position. But as soon as one or more of the yarn threads become broken or disconnected, the guides resting upon such threads are released, and fall upon the frame holding their fulcra or centres; thereby preventing or stopping a reciprocating rod in connection with the stopping motion of the machine, from completing its action, and causing an instantaneous stoppage to the whole machine. A "faller shaft," having a wire attached to a bell-crank lever, passes underneath the whole series of guides, which, when the machine is stopped, raises such guides into position for the warp or yarn passing under them in their progress to the warping mill.

In Plate IX., fig. 1 is an end elevation of the improved apparatus, showing the method of driving, also the apparatus in connection therewith for disconnecting such driving apparatus from the main driving pulley when any of the warp threads become disunited; and fig. 2 is a sectional view of the apparatus for stopping the machine, and which is in immediate connection with the warp; such arrangement of apparatus therein shown constituting the chief feature of the invention. *a, a*, are the

standards or framing of the machine, in which is secured the frame or supporter *b*, supplied with a series of semicircular or arch-shaped dents or guides *c*, secured and retained in position by means of India-rubber or other elastic medium *d*; this elastic medium, being expanded and contracted by the screw *e*, regulates the distance apart of the guides or dents *c*, causing them to expand or contract. Between each dent or guide is placed a finger or lever *f*, such finger hinging loosely upon the fulcrum rod *g*, extending from end to end of the machine. The yarn, on its passage from the rollers to the beam, passes underneath a bent or cranked portion of the finger or lever *f*, at the point *f'*, thus keeping such finger, by the tension of the yarn, in an elevated position; but when one or more of the yarn threads breaks, the finger *f*, no longer sustained in an elevated position by the yarn, immediately falls upon the frame *b*, as shown in dots, and effects the stoppage of the machine by the mechanism hereafter described.

In fig. 1, *h*, is the driving shaft, which transmits motion, through the friction pulley *i*, to the large disc or pulley *j*. The friction pulley *i*, is so arranged, that it can be adjusted upon the driving shaft, bringing it nearer to or further from the centre of the disc *j*: by this means any required speed may be given to the machine. The pulley *k*, driven by the disc or pulley *j*, revolves loose upon the shaft *l*; to this pulley *k*, is attached a sliding stud *m*, pressing upon and resting in a hollow or recess formed in the periphery of the small disc *n*, (see fig. 3) which is keyed upon the shaft *l*: the pulley *k*, as it revolves, drives the shaft *l*, through the medium of the stud *m*, and disc *n*. Upon the shaft *l*, are secured plates *o*, supplied with wires or rods *o'*, revolving with the shaft immediately underneath the framing *b*; so that when one or more of the fingers *f*, fall, or assume the position shown in dots (fig. 2), the rods or wires revolving with the shaft *l*, come in contact with such faller fingers; thereby stopping the revolution of the shaft *l*, and disc *n*,—causing at the same time the stud *m*, in the driving pulley *k*, to rise out of the recess in the disc *n*, and come into contact with the cranked lever *p*; such lever causing the release of the stop-rod *q*, which is attached to the disc *j*, driven by the friction wheel *i*. When this contact takes place, the stop-rod *q*, is released; so that by means of the spring *r*, it forces back the disc *j*, out of contact with the driving friction pulley *i*, and the stoppage of the machine is immediately effected. *s*, is a rod beneath the fingers *f*, for simultaneously raising them when piecing the ends of the yarn or warp.

The patentees claim, "the arrangement, and construction and adaptation, of the apparatus for effecting the stoppage of the mechanism employed in the processes of warping and beaming when any of the threads become disunited, as described."

*To JOHN TATHAM, of Rochdale, Lancashire, for improvements in machinery or apparatus for preparing cotton and other fibrous materials for spinning.*—[Dated 23rd February, 1863.]

THIS invention relates, firstly, to the drawing frame, and consists in a method of driving the coilers thereof. For this purpose, the line shaft is placed above the carrier wheels, which impart motion to the said coilers. To permit of this arrangement, the beam which supports the stands or

slides is formed so that the top of the stands extends partly only between the front and back portions of the beam.

Another part of the invention relates to feed rollers of preparing machinery, and consists in so disposing them, that the fibrous material is caused to lap around one or more of their surfaces.

The invention further relates to the slubbing frame, and consists in conducting the material, after it leaves the delivering rollers, and before it reaches the flyer, through a trumpet or guide, whereby the sliver is brought into a cylindrical form.

In Plate X., fig. 1 represents part of a drawing frame in section, constructed according to this invention. *a, a*, are the drawing rollers mounted on the stands *b*, which are supported by the beam *c*. This beam, instead of being continued, as usual, from the back *c'*, to the front *c''*, is discontinued at the point *d*, so as to leave an aperture in its upper surface; the front and back being connected by midfeathers at suitable distances apart. The line shaft for the coilers is at *e*, carrying bevil wheels, one of which is shown at *f*, situate within the aperture above-mentioned of the beam, and taking into a pinion *g*, mounted upon a stud, and carrying at the other end of its boss a carrier wheel *h*, which drives the coiler plate *i*. This arrangement is of course repeated for as many coilers as are employed. The aperture in the top of the beam, instead of extending along the whole of its length, may be formed at those situations only which are required for the bevil wheels *f*.

The next part of the invention is illustrated at fig. 2, in which *k*, may be considered the licker-in of a carding engine, or the beater of an opener, scutcher, or other such machine. *l, l'*, are ordinary feed rollers, before which are two other rollers *m, n*, so arranged that the one shown at *m*, causes the material, as it passes towards the machine, to lap partly around the surfaces of *l', n*. This arrangement may be repeated if desired, and other combinations may be adopted, which will cause the above-described lapping to take place: as, for instance, the rollers *n*, may be omitted.

Fig. 3 shows that part of the invention which relates to the slubbing frame. The front pair of rollers is shown at *o*, delivering the material to a trumpet-shaped guide *p*, fixed to the frame-work, from whence it passes to the flyer *q*, having acquired a cylindrical form by its passage through the guide *p*.

The patentee claims, "Firstly, and in reference to drawing frames, placing the line shaft for driving the coilers above the carrier wheels, illustrated at *h*, and forming an opening or openings on the top of the beam for the purpose above mentioned. Secondly, as applied to carding engines and openers or scutchers, or other such machines, so arranging the feed rollers that the material is caused to lap around the surface or surfaces of one or more of them, as described. Thirdly, in reference to slubbing frames, the application of a trumpet-shaped guide between the rollers and the flyer."

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To ROBERT BURLEY, of *Glasgow*, for *improvements in handles for hammers, mallets, picks, mattocks, and similar tools*.—[Dated 10th February, 1863.]

THE object of this invention is to impart increased strength to handles for hammers, mallets, picks, mattocks, and similar tools, and at the same time to permit of the use of wood of smaller sizes than is required for handles of the ordinary kind. This invention consists in making handles of two or more pieces of wood of the same or of different kinds, glued or otherwise cemented together. In Plate X., a handle made of three longitudinal pieces is shown in edge view at fig 1, and in cross section at fig. 2. All the three pieces are, by preference, of the full length of the handle, and they are arranged so that the junction lines in the cross section are parallel to the longest diameter; they may, however, be arranged with the junction lines at right angles to those shown, or in other directions. The middle piece is, by preference, of a tough elastic wood, such as lancewood, hickory, or oak, whilst the side pieces may be of ash, larch, or other comparatively soft wood. When common glue is used for cementing the pieces of wood together, and when the handle is to be used under circumstances exposing it to moisture, a small groove is run along the surface at each joint line, and this groove is filled in with marine glue or other suitable matter which is impervious to moisture. The joints may also be protected, and at the same time a little additional strength may be imparted to the handle by cementing leather, or thin cane, or other like material, over the joints, or more or less entirely round the handle.

In some cases, the main part of the handle may consist of one piece of wood, additional pieces being cemented on at the head only, as shown in the cross section at fig. 3.

In other cases, increased strength may be imparted by embedding a central metal rod between or within two or more longitudinal layers of wood, as shown in cross section at fig. 4. This rod may occupy only part of the length of the handle, as shown, or it may be of the entire length, and be availed of for holding on the hammer head by means of a screw nut and plate. The pieces of wood to form each handle are, by preference, cemented together before turning or shaping the handles.

The patentee claims, "the constructing of handles for hammers, mallets, picks, mattocks, and similar tools, with two or more longitudinal pieces of wood, and in some cases with central metal rods, as described."

To JOHN FREDERICK SPENCER, of *Newcastle-on-Tyne*, for *improvements in steam engines*.—[Dated 13th February, 1863.]

THIS invention relates to improvements in arranging and combining together the parts of steam engines with surface condensers to suit particular requirements and situations. One of the improved arrangements, which has reference to the convenient working of the air and cold water pumps, is suitable where the crank shaft is required to be near the ground line, and where space can be afforded for a horizontal or inclined engine or engines. This is represented in Plate X., at fig. 1, which is a vertical section of the improved engine. *a*, is a hollow piston rod or trunk, having jointed inside it a short connecting rod *b*, which connects

with a vertical lever *e*, working on a fulcrum *c*, some distance below the level of the steam cylinder *d*. The main or usual connecting rod *f*, is jointed to the vertical lever *e*, at a point *g*, below the joint of the connecting rod *b*. It may, however, be jointed to the vertical lever *e*, at any convenient point above, below, or in the line of the cylinder *d*; the throw of the crank *h*, being correspondingly greater or less, or equal to the stroke of the piston *i*. Separate pumps for the air and for the cold water may be used; but it is preferred to employ a combined air and cold water pump *j*, *k*, as shown, when there is only one steam cylinder *d*; the pump being placed horizontally beneath the steam cylinder *d*, and condenser *l*, and being worked from the lever *e*, by a rod jointed inside of the hollow piston rod or trunk *m*, of the pump piston. The feed pump may also be disposed horizontally in any convenient position, and be worked in a similar way from the lever *e*. The surface condenser *l*, is placed immediately under, and forms the support of the cylinder *d*; and it may be cast in one piece with, or be united to, the frame pieces *n*, having at the opposite end the bearing or bearings for the crank shaft *p*. The condenser *l*, with the side frame pieces *n*, is firmly bedded on and bolted to masonry or timber foundations, as may be required; and the air and cold water pump *j*, *k*, is bolted to the under side of the condenser *l*. The condenser *l*, is represented as arranged internally, according to the usual system; the tubes being placed horizontally and parallel to the axis of the steam cylinder *d*. The inner end *k*, of the pump acts on the cold water, forcing it into a lower compartment between the inner tube plate and cover of the condenser *l*; from which compartment the water passes through the lower half of the tubes to the other end, returning again to the inner end through the upper half of the tubes. The back or outer end *j*, of the pump acts on the water of condensation and the air—these reaching it from the condenser *l*, by passages, the arrangement of which will be easily understood. With these arrangements both ends of the condenser are conveniently accessible for examining the tubes and the various passages, and other details can be got at with facility. When two steam cylinders are used, each may be combined with a separate surface condenser, similarly to the arrangement described; or a single surface condenser may be placed between the two cylinders, and at a level sufficiently low for the exhaust ports to drain into it; and in this case the condenser shell, bedded on and bolted to masonry or timber foundations, forms the support of the cylinders inside, whilst, outside, they are supported by masonry or timber, as required. The patentee also shows a modification suitable where an elevated crank shaft is required. Fig. 2 represents this modification in connection with a single steam cylinder engine. In this case the condenser *l*, is placed partly or entirely under the ground level, and is carried by two hollow-chambered legs *q*, *r*, one leg *q*, forming the hot well, and the other *r*, an air vessel for the cold water pump. On the top of the condenser *l*, there are placed a vertical steam cylinder *d*, and an arched or two-legged standard *s*; the latter carrying one of the bearings for the crank shaft *p*, and having attached to it the piston rod guides *t*,—the piston rod *u*, and crank pin *v*, being connected together by the common connecting rod *w*. The steam cylinder *d*, considerably overhangs the condenser *l*,—its outer side being supported by columns or standards *x*, resting on a sole plate *y*. Below and on this sole plate *y*, are fixed vertically, either separate air and cold water pumps, or, as is

preferred, a combined air or cold water pump *j*, which is worked directly from the main steam piston by a rod *z*, passed through a stuffing box in the bottom or lower cover of the steam cylinder *d*. The valve chambers and passages in connection with the pump *j*, are arranged conveniently for access. If two steam cylinders are used, the second cylinder, with vertical pump below it, may be similarly arranged at the other side of the condenser, additional standards being provided, as required.

The patentee claims, "the arranging or combining of the parts of steam engines with surface condensers substantially in the manner described."

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*To JOHN GRANTHAM, of Nicholas Lane, City, for improvements in hydraulic presses.*"—[Dated 13th February, 1863.]

THE object of this invention is to vary the amount of power given out by a single ram in a hydraulic press, although the pressure of water or other liquid may be uniform.

The first part of the invention relates to an arrangement by which the power exerted by the ram is increased at a certain distance or distances during the stroke, resulting in an economical process for packing or pressing any material into a smaller bulk, and which requires less pressure at the commencement than at the conclusion of the stroke, and especially useful where an accumulator is employed. In order to effect this object, both the ram and cylinder in which it works are constructed of two or more diameters, each of which is provided with a packing of the ordinary kind. The ram has a telescopic shape, but does not slide within itself: its smallest diameter is first operated upon by the water pressure, by which it is forced to a certain distance, when the next diameter is also operated upon, giving an increased force, and so on to the next, according to the number of gradations in the ram, the power being increased proportionately to the increased diameter of the ram. The spaces between those portions of the ram and cylinder formed during the traverse, but not yet supplied with the high pressure, are filled up by means of a flow of water at a low pressure from a pipe fitted with a self-acting valve, which closes immediately the high pressure is turned on and prevents the water from receding. For the purpose of turning on the water from the accumulator or pumps to the increased diameter or diameters of the ram at the proper time and distance of traverse, a pipe communicating either direct with the small end of the cylinder or with a supply pipe, is fitted with a stop valve and lever: this lever may be actuated in any convenient manner by the traverse of the ram so as to set on the valve as required. Another convenient method for turning on the high pressure of water is effected by forming holes or longitudinal or diagonal slots for a certain distance, on the side of the ram, so that when it has traversed such distance, the water pressure may be communicated past the packing from the smaller diameter of cylinder to the next of larger size.

The second part of the invention relates to an arrangement in which the power exerted by the ram is greater at the commencement of the stroke than at the conclusion. For this purpose the ram is constructed of a telescopic form, consisting of one ram sliding within another, of larger diameter but of less length; the external ram sliding within a

cylinder provided with a shoulder or stop. When the pressure from the accumulator or force pump is applied, it operates upon and actuates both the rams, which traverse together a certain desired distance, until they arrive at the projection or stop, when the pressure actuates only the internal ram, which, being of smaller diameter, exerts a diminished force and requires less water.

In Plate IX., fig. 1 refers to the first part of the invention, and is a vertical section of the improved press. *a, b, c*, is the ram, having two different diameters; *d, e*, is the cylinder, with corresponding diameters. The part of the ram at *c*, is worked in the cylinder at *d*, and the part at *b*, is worked in the cylinder at *e*. *a*, is the ordinary ram for the anvil; *f*, is a pipe communicating with a well or cistern or low-pressure water supply; *g*, is a self-acting valve, which allows water to enter the cylinder from the pipe *f*, but which closes to prevent the water receding as soon as high pressure is applied; *h*, is a stop valve connected by the pipe *i*, to the high-pressure supply pipe *j, k*; the pipe *j*, being connected in the usual manner to the accumulator or force pump, and the pipe *k*, communicating with the small diameter of the cylinder *d*. *l, m*, is a lever and rod with adjustable balance weights, and attached to the valve *h*; *n*, is a rod attached with the lift *o*, to the ram, and by means of the slot at *p*, actuating the lever, and opening the valve at the required distance of traverse.

The press is worked as follows:—When the ram is at the top of the cylinder, the valve *h*, is closed, the high pressure is set on to the cylinder at *d*, and the ram is forced onward, the low-pressure water filling up the space formed in the cylinder at *e*. At a certain desired distance of the ram's traverse, the rod *n*, moves the lever *l*, and opens the valve *h*, when immediately high pressure is exerted in the cylinder at *e*, as well as at *d*,—closing the valve *g*, and exerting an increased force on the ram proportionate to the larger diameter of the part *b*.

Fig. 2 is a vertical section of another press, and refers to the second part of the invention. *a'*, is a small ram; *b', b'*, is a larger ram with a shoulder; it is hollow, and fitted as a cylinder to allow the ram *a'*, to work within it; *c', c'*, is the outer cylinder, fitted to allow the ram *b', b'*, to work within it; *d', d'*, is the stop attached to the cylinder *c', c'*; *e'*, is the water supply; *f'*, is the head to the ram *a'*; *g', g'*, is the head to the ram *b', b'*. When the rams are at the base of the cylinder *c', c'*, the force of the water actuates both rams, until the shoulder of the ram *b', b'*, impinges upon the stop *d', d'*, (which is the position shown) when the ram *a'*, only is in action, and which slides within the cylinder *b', b'*.

The patentee claims, "the improvements in hydraulic presses, firstly, for increasing the force of the ram at the latter portion of the stroke, and, secondly, for causing the ram to have more force at the commencement than at the latter portion of the stroke, in the manner described."

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*To JOSIAH GIMSON, of Leicester, for improvements in presses for punching or cutting out leather and other substances.*—[Dated 17th February, 1863.]

THIS invention relates to that description of press in which knives or cutting tools with sharp edges, bent in any desired form, are used to cut

out pieces of leather. These cutting tools are usually made about two inches deep; and two, three, four, or more tools are frequently adapted to the same press, in order to economize time and labor. But as the knives or cutting instruments, and also the under blocks, do not always wear away equally, considerable difficulty is experienced in using in the press, at the same time, several knives and blocks of different depths or thickness.

To obviate this inconvenience, the patentee employs as many adjustable pressing surfaces as there are knives or cutting instruments, so that each pressing surface may be adjusted separately to suit the knife with which it is intended to be employed.

In Plate IX., fig. 1 is a front elevation of the press, showing two cutting knives and blocks; and fig. 2 is an end elevation of the machine. *a, a*, is the main framing of the machine; *b, b*, is a moveable cross head, provided with adjustable pressing surfaces or plates *c, c*, which are moveable vertically by means of their respective screws, as shown. The cross head is supported by the side arms *d, d*, which are connected together at their lower ends by the cross shaft or rod *e*. Links *f, f*, shown by dots in figs. 1 and 2, connect the shaft or rod *e* with the excentrics *g, g*, on another cross shaft *h*, on one end of which is keyed a box wheel *i*, provided with internal teeth, into which gears a pinion *j*, on the driving shaft *k*, which is driven by a band passed round the pulleys *l, l*. The knives are shown at *m, m*, and the under blocks at *n, n*; the strips of leather *o, o*, being between the knives and the blocks. Upon motion being communicated to the driving shaft *k*, the excentrics *g, g*, will draw down the cross head and adjustable pressing surfaces *c, c*; and by causing them to press on the top of the knives, the latter will cut through the leather on the block *n*. It will be evident that as the pressing surfaces *c, c*, are adjustable vertically by means of their respective screws, their position may be regulated to suit the varying thicknesses of under blocks and the depth of the knives or cutting instruments. As a modification of the above, the cross head *b*, may remain stationary, and the under blocks be made to rise and carry up the knives and under blocks to and against the pressing surfaces; or the under blocks *n, n*, may be made adjustable vertically, instead of the pressing surfaces *c, c*.

The patentee claims, "rendering the pressing surfaces or other equivalent parts adjustable vertically, so that they may be made to suit varying depths of the cutting instrument and thicknesses of the under block, as herein set forth."

*To CHARLES BILLINGSLEY, of Manchester, for improvements in saddlery, harness, driving straps, and similar articles.*—[Dated 20th February, 1863.]

THIS invention consists, first, in an improved fastener, intended as a substitute for the ordinary buckle, which fastener is applicable to the traces, kicking straps, crupper straps, tugs, and other parts of harness or saddlery, and also to the driving straps of machines, or other purposes where buckles have hitherto been used for uniting the ends of a single piece, or the two ends of two pieces together. Secondly, in an improved

mode of attaching the stirrup leather to the saddle. A single strap is employed, with a loop at the end, to fit on the spring bar of the saddle, which arrangement prevents the necessity of several thicknesses of strap and buckle, which cause inconvenience to the rider, and great disfigurement of the saddle.

In Plate IX., fig. 1 is a side view of a stirrup leather; the upper part being adapted to fit the spring bar of the saddle, and the lower or bottom part for having the stirrup fastened to it by the improved fastener, which lower part is suitable for all articles or purposes requiring a similar fastening; fig. 2 is a front view of a fastening; and fig. 3 shows it applied to the coupling of two straps. Fig. 4 is an edge view of a metal plate, with a single stud.

The strap *a*, (fig. 1) has at the lower end a number of holes, and near the part where the stirrup or other article is intended to be fastened there is a fixed clip *c*, and a fixed metal plate *d*, having a stud *e*. When it is required to suspend the stirrup and fasten the strap, the perforated end is passed through the fixed clip *c*, and one of the holes is passed over the stud *e*, which is thereby made to project through the strap, and by that means the two parts are held firmly together,—the extreme end *f*, being prevented from shifting by means of a loose or fixed clip *g*. The metal plate *d*, is rivetted to the strap, or otherwise fixed in any desired manner.

In fig. 3, representing the application of the improved fastener to the two ends of two straps, or to the two ends of one strap, the two ends are shown at *h*, *i*: the end *h*, is perforated with a number of holes *k*, for lengthening or shortening, and the end *i*, has fixed to it the clip *l*, and the metal plate *m*, (fig. 2) carrying the fixed stud *n*. The two ends are fastened together by passing the perforated end through the clip *l*, and then passing one of the holes over the stud *n*, until the stud projects through the strap, and holds the two parts together, and then the extreme end *o*, is enclosed in the loose or fixed loop *p*.

The improved mode of attaching the stirrup leather to the saddle is shown in fig. 1. The strap *a*, is single, and has at the top a loop *q*, to fit on the spring bar of the saddle, which arrangement prevents the necessity of several thicknesses of strap and consequent inconvenience to the rider, and great disfigurement of the saddle.

The patentee claims, "First,—the method of fastening straps used for harness, driving bands, and other similar articles, by means of the improved fastener, intended as a substitute for the ordinary buckle. And, Secondly,—the improved mode of attaching the stirrup leather to the saddle."

To FREDERIC JOHN REED, of Gresham-street, for improvements in apparatus for traversing guns,—being a communication.—[Dated 18th February, 1863.]

THE figure in Plate IX. shows an end view of apparatus for traversing guns constructed according to this invention. *a*, *a*, are the rails of the chasses, and *b*, is the rear transom. *c*, is the upper horizontal shaft, carried by two boxes *c*<sup>\*</sup>, *c*<sup>\*</sup>, secured to the under surface of the left-hand rail *a*, near the rear transom *b*; *c*<sup>1</sup>, is the driving pinion upon the shaft *c*; and *c*<sup>2</sup>, is the cranked handle upon the same shaft. *d*, is the lower

countershaft, carried also by two boxes, represented by  $d^1$ ,  $d^1$ . On the countershaft  $d$ , is the spur wheel  $d^2$ , which gears with, and is driven by, the pinion  $c^1$ ; and  $d^3$ , is the bevelled pinion on the same shaft, which gears with, and drives, the bevelled wheel  $e$ , on the upright shaft  $e^1$ , which is carried in boxes  $e^2$ ,  $e^2$ , secured to the hinder face of the rear transom. The shaft  $e^1$ , has shoulders upon it, to prevent it sliding longitudinally in its bearings.  $e^3$ , is a pinion, secured to the lower end of the shaft  $e^1$ , and this pinion  $e^3$ , gears with the toothed arc  $f$ , which is fixed upon the traverse bed, just outside the traverse circle. Thus it will be seen, that by turning the crank handle  $c^2$ , in one or other direction, the rear end of the carriage may be traversed to the right or left, as may be desired.

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*To WILLIAM CLARK, of Chancery-lane, for an improvement in boilers for disintegrating and pulping vegetable substances,—being a communication.*—[Dated 20th February, 1863.]

THIS invention relates to boilers for the reduction of vegetable substances to the condition of pulp, suitable for paper stock, or for their disintegration for any other purpose, either with or without the aid of alkalies or other chemicals; the principal object being to ensure the complete submergence of the substances in the liquor or solution during the boiling process.

The figure in Plate X. shows the improved boiler A, with a man-hole  $a$ ,  $a$ , at the top with a man-head  $b$ , fitted to the man-hole, and secured in any well-known or suitable manner. B, is a perforated screen or diaphragm, arranged horizontally, and secured to the sides of the boiler;  $c$ ,  $c$ , is a man-hole in the centre of the screen; and  $d$ , a man-head fitted to the man-hole. G, is a perforated cylinder or well, connected at the top with the head or crown of the boiler, and at the bottom with the screen B, and forming a communication from one man-hole to the other.  $c$ , is a pressure gauge, and D, a safety valve on the top of the boiler; E, is a pipe at the bottom of the boiler for discharging its contents, fitted with a suitable valve F. The boiler, if deemed necessary, may be provided with stirrers or agitators driven by gearing.

The mode of operating the boiler is as follows:—The man-heads are both removed, and the boiler charged with the vegetable substances up to, but not above, the man-hole  $c$ ,  $c$ ; and the lower man-head  $d$ , is then put on and secured. The liquor or chemical solution, of proper strength, is next introduced in such quantity that it will just cover the man-head  $d$ , completely submerging the vegetable substances. The upper man-head  $b$ , is then put on and secured, and the necessary heat applied and continued until the contents of the boiler have been sufficiently acted upon by the heated liquor or solution. The heat may be obtained in the boiler either by steam admitted in a coil or otherwise, or by the direct application of fire. If the latter mode of heating be adopted, the fire may be placed in a suitable car or travelling furnace H, under the bottom of the boiler, and removed after the boiler has been subjected to its action for a suitable length of time. By opening the valve or gate F, the contents of the boiler are discharged by the pressure of steam into any suitable receiver.

The patentee claims, “a boiler for disintegrating or pulping vegetable substances, constructed substantially as described.”

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*To JOSEPH FITTER, of Birmingham, for an improvement or improvements in the construction of castors for tables, chairs, and other furniture, or other articles.*—[Dated 25th February, 1863.]

THIS invention consists in the arrangement of a series of antifriction rollers within an inverted circular groove formed round the under side of the castor socket, or round the under side of the plate upon which the article to be moved is intended to rest, if applied to a plate castor.

In Plate X., fig. 1 is a cross section of a socket castor, showing the antifriction rollers in working position. *c*, is the horn of the castor, which works underneath the antifriction rollers *b, b*, and holds the bowl upon which the castor runs. Fig. 2 is a cross section of a plate castor complete, showing the antifriction rollers *b, b*, in their respective places; *c*, being the horn of the castor, which revolves beneath the antifriction rollers *b, b*, and contains the bowl upon which the castor runs. The socket of the castor is made with a rim round the outside of the bottom, to enclose the outer edge of the disc or plate forming the top of the horn *c*, of the castor, and upon which the antifriction rollers revolve. Inside this rim is a cast circular groove. In the centre of the socket is formed a hole, into which is rivetted a pin or spindle, which is made to pass through a hole in the centre of the disc or upper part of the horn *c*,—the hole being made sufficiently large to allow the horn to revolve freely round it. The end of the pin is secured beneath the disc or plate by means of a screw nut, or otherwise; thereby connecting the socket and the horn of the castor together, after having loosely filled the circular groove with the loose antifriction rollers. The manner in which the improved castor is applied to the legs of brass or iron bedsteads, and any metallic furniture, or other metallic articles, is as follows:—A collar is welded to the bottom of the legs or uprights which support such metallic articles, within which is turned a circular groove similar to the grooves of the castor, a pin or spindle being put in the centre; the antifriction rollers are then placed in the groove, and the horn is attached thereto, by passing the pin or spindle of the leg or upright through the hole in the centre of the disc or plate forming the top of the horn, and then rivetting or otherwise securing it underneath. The hole in the top of the horn is made sufficiently large to allow the horn to revolve freely round the spindle or pin, precisely in the same manner as in the socket and plate castors. Where the leg or upright of the furniture or other article is hollow, a socket is made to fit the same, and it is rivetted or screwed to the upright or leg, or fixed in any other way that may be more desirable.

The patentee claims, "the new or improved castor, as described, and the mode of applying the same to brass or iron bedsteads, or other metallic furniture, or other articles."

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*To HENRY WYCHERLEY, of Oldbury, Worcestershire, for certain improvements in the construction of, and mode of applying, wings or dirt screens over the wheels of carriages.*—[Dated February 11th, 1863.]

THIS invention has for its object the prevention of the vibration commonly imparted to the dirt screens over the wheels of carriages, arising from the mode now commonly adopted of attaching the parts to the bodies of carriages above the springs. The improvement is effected by



attaching independent auxiliary springs, either outside or inside, above or below the springs used for supporting the carriage body; and to the ends of these auxiliary springs are formed extensions that support the wings.

In Plate IX., fig. 1 is an end view of a pair of wheels marked  $a, a^1$ , attached to the axletree  $b, b$ .  $c, c$ , and  $c^1, c^1$ , are the springs for supporting the body of the gig or carriage, and may be of this or any other form of construction now commonly used.  $d, d$ , and  $d^1, d^1$ , are the auxiliary springs, to which are attached the connecting arms  $e, e$ , and  $e^1, e^1$ , for connecting and supporting the wings or dirt screens  $f, f$ , and  $f^1, f^1$ ; while the vertical or central portions of the dirt screens are supported by arms  $g, g$ , which are held by two vertical screws secured to the seat of the auxiliary springs.  $h, h^1$ , are pins for holding the part  $g$ , in a central position; such pins passing down through the arms  $g, g$ , and auxiliary springs  $d$ , and  $d^1$ , into the seats  $j$ , and  $j^1$ , for supporting the same. Between the under sides of the heads  $h$ , and  $h^1$ , and the top sides of the auxiliary springs  $d$ , and  $d^1$ , sufficient play is left to counteract the irregular motion of the wheels travelling over a rough road, transferring that motion to the wings; and this is effected by the elasticity of the auxiliary springs, which being connected to the wings by the arms  $e$ , and  $e^1$ , destroy the slight vibration that would otherwise occur. The space between the lower surface of the arm  $g$ , and the top side of the spring  $d$ , shows the proportionate distance requisite to allow for the elastic force of the springs (see fig. 2), which is a sectional view of fig. 1. Supposing the wing  $f$ , with its arm  $g$ , was depressed to the extent of the distance left between the surface of the auxiliary spring and the under surface of the arm  $g$ , it would be in the position indicated by the dotted semicircular line marked  $m$ , being about equi-distant from the periphery of the wheel. Supposing the arrow  $n$ , to represent the direction the wheel may be travelling, a scraper  $p$ , may be applied to the wing, and be so conveniently set with its lower edge in immediate proximity to the wheel, as not only to prevent splashes being thrown up, but also to scrape from the periphery of the wheel, snow, dirt, or other objectionable matter over which carriage wheels are liable to pass, and yet be so constructed as not to offer any undue pressure or resistance to the general free action of the wheel.

The patentee remarks, that the invention may be diversified in a variety of ways, according to the style of two or four-wheeled carriages to which the same may be applied: as, for instance, an additional supporting spring may be applied, as exhibited at  $r, r$ , (fig. 1) the same being secured to a seat fastened to the centre of the axle; this spring unites its effect upon both ends of the arm  $g, g$ , so as to keep it uniformly elevated against the heads of the pins  $h$ , and  $h^1$ .

The patentee claims, "the use of auxiliary springs, secured to the axle, for supporting the wings or guards of carriages, in contradistinction to their being supported or connected with the bodies of such carriages."

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*To JOHN WATSON BURTON, of Leeds, for improvements in the bearings and bushes of axles and shafts.*—[Dated 24th February, 1863.]

ACCORDING to this invention, the part of the bearing against which the axle or shaft works is composed of glass or other similar hard and

smooth material, and the flanges or outer parts are composed of brass or other suitable metal. Between the bearing and the flanges, pieces of wood, papier-maché, felt, India-rubber, cloth, or other similar non-metallic and partially elastic substance are inserted, and the several parts are united as required by means of countersunk bolts, or in any other convenient manner. By this combination of materials there is provided a hard and smooth bearing of a more permanent character than those in ordinary use, resting at each end against a kind of cushion of partially elastic material.

In Plate X., fig. 1 is a side elevation of a bearing for a shaft; and fig. 2 is a transverse section of the same. A, is the part against which the shaft works, and is composed of glass; B, B, are the flanges composed of brass, and forming the outer part or casing of the bearing A. Between the parts A, and B, are inserted pieces of wood, papier-maché, felt, India-rubber, cloth, or other similar non-metallic and partially elastic substance or material C, shown by dotted lines in fig. 1. The parts are shown as connected together by means of countersunk bolts. D, is an ordinary oil cup. It will thus be seen, that by means of the above-described combination, a shaft inserted in the plummer block in the usual manner would be provided with a hard and smooth bearing of a permanent character at A, resting against a kind of cushion of partially elastic material C, enclosed by the metal flanges or casing B.

The patentee claims, "the combination of parts composed of the materials hereinbefore described, for the purpose described."

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*To ALFRED VINCENT NEWTON, of the Office for Patents, 66 Chancery-lane, for improvements in projectiles for ordnance, and in fuses therefor,—being a communication.—[Dated 7th April, 1863.]*

THIS invention relates, firstly, to the employment of fulminates of silver and mercury, and other fulminating compounds, for the bursting charges of explosive projectiles, its object being to obviate the accidental explosion of such charges in the handling or transportation, or by the dropping, of the projectiles.

The improvement consists in the use, either mixed with the fulminate, or interposed between small quantities of the fulminate so employed, of cotton, gun cotton, curled hair, wool, flocks, saw-dust, or other soft, fibrous, or granular substance, to reduce the force of the concussion between the grains of the fulminate; also in the lining of the charge chamber of the projectile with woollen, cotton, or other cloth or flannel, or other soft material, for the same purpose; also in the division of the charge into a number of parts, by means of rigid partitions in the chamber, whereby the force of the concussion produced between the particles of fulminate, in case of dropping the projectile, or subjecting it to severe concussion, is reduced.

The invention relates, secondly, to the use of metallic packing, for preventing the windage between the projectile and the bore of rifled ordnance, and for obtaining a rotary motion of the projectile in its passage through the bore.

The invention relates, thirdly, to improvements in percussion fuzes, for the ignition of the bursting charges of explosive projectiles.

In Plate X., fig. 1 is a central longitudinal section of an elongated explosive projectile, in which the several improvements are illustrated, showing the several parts of the fuse in the condition in which they remain until the act of firing the projectile from a piece of ordnance commences. Fig. 2 is a central longitudinal section of the fuse, showing the parts in the condition they assume after leaving the gun. A, is the body of the projectile, having a central chamber, of cylindrical form, for the reception of the bursting charge c, c. This chamber is loaded through an opening a, a, in the base of the projectile, which is of as large diameter as the chamber itself, and is fitted with a tight screw-plug b, to confine the charge. h, h, are the partitions which divide the charge c, c, into as many parts or sub-charges as may be desirable, the said partitions being composed of perforated metal discs, fitting snugly to the chamber. Each of the sub-charges is put into the chamber in a separate metal tube d, which fits to the chamber, and the said tubes serve as a means of supporting the partitions h, h, so that no one sub-charge can possibly be subjected to the pressure due to the weight of another or others. Each compartment of the chamber is lined with cloth, flannel, or other material e, which may be done by inclosing the sub-charges in bags, such bags forming the linings of the compartments. It is proposed to employ for the charges a mixture of about three parts, by weight, of fulminate of mercury, and one part cotton, gun cotton, wool, sawdust, or other soft material, which will tend to break the force of the concussion between the particles of fulminate, in case of the dropping or jarring of the projectile, and in the firing of the projectile from the gun. The projectile, thus charged, may have its charge ignited by a percussion or time fuse, and the fire is conveyed from one sub-charge to another, through the perforations in the partitions h, h. B, is the packing ring of brass or other suitable metal or alloy, fitted to a projection f, on the base of the projectile, such projection being made of polygonal form, to prevent the ring from turning. This ring is made convex in front and concave in the back, to permit of its being expanded circumferentially by the driving forward of its outer portion. c, is the follower, consisting of a stout plate of metal of a circumference a little smaller than the bore of the gun from which the projectile is to be fired, and having a rounded flange i, projecting in a forward direction from its circumference. This follower is attached to the forward end of the projectile by a screw bolt g, which passes through a hole in its centre, and screws into a tapped hole in the centre of the plug b, and which holds the flange i, in contact with the back of the packing ring. When the gun is fired, the explosion of its charge acting upon the follower, drives it forward against the back of the packing ring, and so, by flattening the said ring in a greater or less degree, produces the circumferential expansion of the ring, thereby causing it to fill the bore and enter the grooves of the gun. The follower is prevented from being driven up further than is necessary to produce a proper expansion of the ring by coming in contact with the base of the projectile. D, is the fuse tube, made of brass or other metal, with a solid flanged head j, and screwed into a tapped hole in the head of the projectile. k, is a pin, secured in the centre of the head j, and extending about half the length of the tube D. l, is a

small tube of brass or other metal, fitted to work easily on the pin *k*, and having at its front end a flange *l'*, and two lugs *l''*, *l'''*, by which it may be supported against a tubular plunger *m*, which is just small enough to work easily within the cylindrical interior of the tube *D*. The rear end of the tube *l*, is fitted to a countersunk opening in the centre of a cup *n*, which is screwed into the interior of the tube *D*, and which thus serves to hold the tube *l*, in place, with its lugs *l''*, *l'''*, against the plunger, and so to hold the plunger against the head of the tube *D*. The length of the tube *l*, is the same as that of the pin *k*, and the plunger *m*, is of about half that length; so that when the tube is held in place, as represented in fig. 1, the pin *k*, enters about half way through the tube *l*. *p*, is a spring coiled round the tube *l*, and compressed against the flange *l'*, thereof by means of a cup *q*, which is screwed into the tube *D*, before the cup *n*, and which has a central opening, just large enough for the tube *l*, to pass through. *r*, is a plate screwed into the rear end of the tube *D*, after the insertion of the cup *n*, and used for closing the rear end of the cup.

The portion of the interior of the tube *l*, not occupied by the pin *k*, constitutes the chamber *s*, for the fulminate; and the annular space *t*, between the cups *n*, and *q*, surrounding the said tube, constitutes the chamber for the sand or other hard granulated material, by the friction of which the fulminate is to be ignited when the projectile strikes; but these chambers are separated by the tube *l*, and cups *n*, and *q*, so that there is no communication between them until the projectile leaves the gun, when what may be termed the lock, composed of the lugs *l''*, spring *p*, and plunger *m*, is unlocked, and the two chambers are allowed to communicate, as will be presently described.

It is proposed to use in the chamber *s*, a mixture of about three parts by weight of fulminate of silver, and one part of cotton, gun-cotton, saw-dust, or other soft material; the soft material being to prevent accidental or premature explosion. In the chamber, both before and behind the fulminate mixture, there are placed small cushions, *v*, *v*, or wads of cotton or other soft material,—gun-cotton being preferred at the rear end. The whole tube *l*, is lined with a piece of cotton, flannel, or other soft cloth, *u*, to form a lining for the chamber *s*. The cup *n*, contains a small charge *w*, of gunpowder to ignite the bursting charge of the shell, and between this gunpowder, and the fulminate mixture in the chamber *s*, there is placed in the mouth of the tube *l*, a little fulminate of quicksilver, to insure the ignition of the charge of gunpowder in the cup *n*; the fulminate of silver, sometimes, owing to its extremely rapid combustion, failing to ignite gunpowder, though it will ignite the fulminate of mercury, which, burning more slowly and with a stronger flame, will ignite the gunpowder.

When the gun is fired, and the projectile is started by the sudden impact of the explosion of the gunpowder, the inertia of the plunger *m*, causes it to hang back with sufficient force to break off or bend back the lugs *l''*, *l'''*, and so unlock the tube *l*, and allow it to be driven forward by the expansion of the spring *p*, as shown in fig. 2. This driving forward of the tube upon the pin opens the rear end of the chamber *s*, to the chamber *t*, and causes the pin to expel the contents of the chamber *s*, and deposit them into the chamber *t*; or, in other words, the forward movement of the tube merges the chamber *s*, into the chamber *t*, and causes the contents of the two to be mixed; so that when the projectile strikes,

the concussion between the particles of fulminate and the sand or other hard granular material may produce the ignition of the fulminate, which ignites the charge *w*: the explosion of this charge blows out the disc *r*, and produces the ignition of the bursting charge of the projectile. The above-described forward movement of the tube *l*, upon the pin is prevented from taking place, until the projectile has left the gun, by the constant acceleration of the velocity of the projectile as it passes through the bore, which is so great as to prevent the elasticity of the spring from overcoming its own inertia, and that of the tube *l*, and the possibility of the explosion of the projectile in the gun is thereby prevented; but after the projectile has left the bore of the gun and there is no further acceleration of its velocity, the tube *l*, is left to the influence of the spring *p*, which drives it forward as far as the head *j*, of the tube *D*. The flanged head *j*, may have a recess in its face, for the reception of a Bormann's or other time fuze.

The patentee claims, "constructing projectiles in the manner above described."

*To ROBERT NEWTON, of Leeds, for improvements in machinery for separating and straightening the fibres of silk waste and other fibrous substances.*—[Dated 13th April, 1863.]

THIS invention relates to a novel arrangement of apparatus, whereby the operation of filling cylinders may be carried on without the loss of time heretofore experienced, when it is required to remove a filled cylinder from the machine and place an empty one instead thereof.

The figure in Plate IX. represents a side elevation of a machine, constructed according to the present invention. *A, A*, are two upright frames, bolted together by cross frame work; *B, B*, are frames, of which there is one at each side, keyed to the shaft *b*, for carrying the cylinders *D*, and *D'*: *c*, are a pair of blocks, which carry the shaft *b*, and frames *B*. These blocks rest upon and embrace the beading of the frame *A*, but are free to move in a horizontal direction. *D*, and *D'*, are the cylinders, which revolve in bearings provided for them in the cylinder frames *B*. *c, c*, are the filling combs, which are fastened to the cylinders *D*, and *D'*. *E*, is a flexible sheet covered with pins set at an angle, as shewn in the drawing. *F*, and *G*, are two rotary or porcupine gills. *H*, and *I*, are two circular brushes to clean the gills *F*, and *G*. *K*, is a lever hung from a stud *a*, and embracing the shaft *b*, and having on its lower end a projecting stud *c\**, which is embraced by the lever *L*. The lever *L*, is keyed to the shaft *d*, which extends across the frame, on the other side of which there is a similar lever *L*. *M, M*, are the driving pulleys, which are keyed fast to the shaft *e*, on which there is a toothed wheel *N*, gearing with the wheel *O*, on the axle of the cylinder *D*. *f, g, h, i, k*, are a series of wheels communicating motion to the roller *R*, which drives the flexible sheet *E*. *l, m, n, o*, and *p*, are wheels on the opposite side of the frame, for giving motion to the porcupine gills *F*, and *G*.

The silk to be operated upon is laid upon the flexible sheet *E*, and fed to the cylinder between the sheet and the porcupine gill *F*. The action of the cylinder combs, which revolve rapidly, is to open and straighten the silk; and an advantage of this machine is, that

the cylinders being only about one-third of the usual size, the combs are able to get closer to the bite of the flexible sheet and gill; thereby straightening the silk better, and permitting fewer lumps to pass through without being combed out. The other porcupine gill G, revolves slowly, and straightens the fibres which are attached to the filling combs C, C. The revolving brushes H, and I, keep the porcupines F, and G, clean. After the cylinder D, has been filled with silk to the required thickness, the machine is stopped; and the workman by pulling the lever L, to the position shown by the dotted line, draws out the cylinder clear of the gills and other working parts, and then, by grasping the projecting handles on the cylinder frames B, causes the latter to make half a revolution; thereby transposing the position of the cylinders D, and D'. The workman then pushes the lever L, back into its former position, where it is retained by the catch E. The conical projection O, on the frames B, enters at the same time into a conical hole in the bracket S, and the frame B, is thus prevented from moving in either direction. The toothed wheel O', on the cylinder shaft slips into gear with the driving wheel N, and the machine is again put in motion. The workman then proceeds to strip the cylinder D, which has been filled whilst the other cylinder D', is engaged in filling. By this means a great amount of time is saved, the machine being nearly always at work; whereas the ordinary machine is stationary about half its time, whilst the workman is stripping the cylinder.

The patentee claims, "the application of two or more cylinders to one filling engine, for operating on silk or other fibrous substances, as set forth; so that one cylinder may be at work whilst the other is being stripped, as above described."

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To WILLIAM EDWARD NEWTON, of the Office for Patents, 66 Chancery-lane, for improvements in wrenches,—being a communication.—[Dated 21st April, 1863.]

THIS invention relates to the construction of improved self-acting wrenches, for screwing and unscrewing nuts, gas pipes, and other articles.

In Plate X., figs. 1, 2, and 3 show one form of the improved wrench in three different positions. *a*, is the main lever, handle, or stem, of the wrench. The inner end of this lever or handle moves in the forked part of the fixed jaw *b*, and turns upon the fulcrum formed by the bolt *c*. *d*, is the second or moveable jaw, which slides in the forked part of the fixed jaw *b*: *f, f*, are straight bars or links of steel (shown by dots in the figures), for connecting the lever *a*, with the moveable jaw *d*: *h*, and *i*, are two joint pins, acting only in moving the moveable jaw backward. At the forward motion, that is to say, if the jaw is pressed or drawn against the nut, the bars or links *f, f*, are pressed directly by a small cam, cut in the lever *a*, against the moveable jaw *d*. By moving the lever or handle *a*, on the pin *c*, (which handle is capable of moving to the right or left, as shown at figs. 1 and 3), this lever, in its movement, either carries with it the pin *h*, or presses with its heel, and forces forward, the bars *f, f*, and with them the moveable jaw *d*. The jaw *d*, thus opens out from, or closes on, the fixed jaw *b*, gripping the nut or tube with

greater or less force, according to the position of the lever, and the amount of force exerted on the handle *a*.

By constructing the wrench with two pairs of jaws of different sizes, as shown in the drawing, the difference in the space between the jaws is more variable, and admits of the wrench screwing or unscrewing a greater set of nuts or pipes of different sizes, thereby increasing the utility of these wrenches. On the other hand, this arrangement admits of the smaller mouth of the wrench being constructed as pincers for extracting nails.

Fig. 4 represents a side view of a modification of the wrench, constructed on the same principle, but furnished with one pair of jaws only—a fixed jaw *b*, and a moveable one *d*. This arrangement is especially adapted for screwing and unscrewing nuts at places where the space of operation is not sufficient to admit of operating with the other wrenches, which are furnished with a double pair of jaws, as before described.

The patentee claims, "the construction of the improved wrenches, for screwing and unscrewing pipes, nuts, or other analogous articles, of any shape or dimensions, whether hexagonal, square, round, or other form, in the manner described."

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*To JAMES CROSBY, of Audenshaw, Lancashire, and JOHN BURNS SMITH, of Bury, for improvements in carding engines for carding and drawing flax tow, in part applicable to carding cotton or other fibrous substances.*  
[Dated 10th February, 1863.]

IN Plate IX., fig. 1 is an end elevation of such parts of a carding engine as are requisite to show the improvements; and figs. 2 and 3 are detached portions thereof. *m, m*, represents a portion, in section, of the main cylinder of a carding engine; *a*, represents a clearer roller of the same, and *b*, one of the working rollers. The angles of inclination of the teeth on the peripheries of the working roller and clearer are shown reversed to each other, as in the usual operation: both the roller and clearer revolve in the same outer surface direction with the main cylinder *m, m*. The clearer *a*, revolves at a much greater surface velocity than the roller *b*, and thereby draws away the fibrous substance from the roller *b*, to deposit again on the main cylinder *m, m*, which revolves at a much greater surface velocity than the clearer *a*. In order more effectually to clean the fibrous substance of the woody, vegetable, and earthy impurities during the operation of carding, two united metallic straight-edges, shown at *n*, and *n'*, are used, of the length of the clearer roller *a*, and set within touching contact of its periphery. The straight-edges *n*, and *n'*, shown in section, are secured to the fixing *d, d*, being placed concentric to the centre of the clearer *a*. The fixing *d, d*, is mounted loosely on the circular bearings or boss of the clearer shaft *c*, but capable of being secured to the segment plate *s, s*, so that when adjusted, the clearer and straight-edges partake of the same adjustment. It may be considered that this appendage of the invention is applied to the clearer *a*, only, but the effect produced is in combination with the working roller *b*, as will be presently understood. The straight-edge *n*, circumscribes a portion of the periphery of the clearer *a*, and is concentric with it, whatever distance of adjustment it may be in from the place of the near approach of the

roller  $b$ , to the clearer  $a$ ; and it must be toothed on the edge \* by transversely-cut grooves. This peculiar concentric form of the straight-edge  $n$ , is for the purpose of confining the fibrous substance in close contact to and within the surface of the teeth which cover the periphery of the clearer  $a$ ; thereby producing the effect, by the quicker velocity of the clearer, of cleaning by the operation of carding, comparatively combing, or hackling the fibrous substance while being drawn away from and through the teeth \* of the straight-edge  $n$ , and from and through the teeth of the roller  $b$ ; which toothed process of operation loosens and releases from the flax tow, or other like fibre, the woody, vegetable, and earthy impurities during the operation of carding. The straight-edge  $n^1$ , also concentrically circumscribes a portion of the periphery of the clearer  $a$ , and is arranged suitably apart from, but united with, the straight-edge  $n$ , to admit of the clearer  $a$ , by its centrifugal force, throwing over the edge of the straight-edge  $n^1$ , the loosened woody, vegetable, and earthy impurities previously released from the fibrous substance by the concentric straight-edge  $n$ .

In reference to this first part of the invention the patentees' claim is, "the connecting, arrangement, adaptation, and combination of two concentric united metallic straight-edges, with their attachment to the frame fixing  $d, d$ , mounted on the axes of the clearer  $a$ , or on the circular bearing or boss of the same; whereby they are enabled, through the teeth \* of the straight-edge, for the purpose of loosening and releasing the woody, vegetable, and earthy impurities of fibrous substances with economy in waste." (*sic*).

Secondly, in so far as regards the construction of ordinary flax tow carding engines, the series of working rollers and clearers are placed, some in a part of the upper arc of the circle circumscribed by the main cylinder  $m, m$ , or above the horizon line of its axis,—others below it.  $g$ , (fig. 1) represents a metal dirt guide, placed lengthwise of the concentric straight-edge  $n^1$ , and secured to it, and to the segmental plate fixing  $s, s, s$ . This guide  $g$ , extends laterally from one clearer to the other, but is attached to those only which are placed in the upper arc of the main cylinder  $m, m$ . "To each clearer so placed, and to its concentric straight-edge  $n^1$ , is secured a guide  $g$ , in appearance somewhat segmentally with each other, till to the approach of the horizontal line of the axis of the main cylinder, which line forms the opening area beneath the main cylinder of the carding engine, to receive, by the declivity of the guides, and the falling downwards by gravity, the refuse woody, vegetable, and earthy impurities which have been loosened, released, and thrown from the flax fibre by the combination of these guides and concentric straight-edges, jointly acted upon by the employment respectively for this purpose."

The patentees claim, with reference to this second part of the invention, "the connecting and combining of the guide  $g$ , with the united concentric straight-edges, the guides employed for allowing the refuse, the woody, vegetable, and earthy impurities, to fall beneath the main cylinder of the carding engine, and whereby they are enabled more effectually to clean the fibrous substance with economy in waste during the operation of carding tow."

Thirdly, the concentric straight-edges  $n$ , and  $n^1$ , with their respective clearers  $a$ , have the same use whenever circumscribing the main cylinder



*m, m*, the effect produced being precisely the same; but in order to obtain the like effect, as the dirt guides *g*, to those clearers and rollers which are placed in the arc below the horizontal line of the main cylinder of the carding engine with the employment of the two concentric straight-edges *n*, and *n'*, woven wire grids or gratings are placed in substitution of the sheet metal dirt guides *g*, and which are placed so as to prevent the useful fibrous substance flying off the clearers, rollers, and the main cylinder, by centrifugal force; these grids being of such formation, and so placed, as to allow only the refuse, the woody, vegetable, and earthy impurities, to pass through them.

The claim is for "the employment of woven wire grids or grating, in substitution of the sheet metal dirt guides *g*, before described, in the arc below the horizon line of the main cylinder of the tow carding engine."

Fourthly, in applying the toothed straight-edge to cotton or wool carding engines, it is modified, as shown at fig. 3, being perforated in the straight line of its edge with small holes, to receive the teeth of a metallic toothed comb *p*: this comb, by a continuous movement of mechanism, alternately advances and recedes, which movement presents alternately and repeatedly a plain straight-edge or a toothed one. It will be evident, by this reciprocating movement of the comb, that the surcharged substance will be released from it. The movement is obtained (see fig. 3), by the shaft *s*, which is the length of the straight-edge, and mounted on bearings attached to the straight-edge at both ends. Upon the shaft *s*, are fixed excentrics or cams, which impart the reciprocating movement to the comb. When applied to cotton, this comb can either be employed with the clearer or the working roller, or with both jointly. When flax tow contains much vegetable impurities, it can be employed with very great advantage.

The claim under this head is, "the application of the moveable comb, moving inwards and outwards through the perforations of the straight-edge, in whatever manner it may be employed for carding cotton or wool; also of thereby loosening and releasing, while carding, comparatively combing, or hackling, flax fibrous substances in tow carding engines."

Fifthly, the plate fixing *s, s, s, s*, contains the bearings for the clearer and working roller, and is in the form of a segment, a consecutive series of which are placed adjustable, partly around, and attached to the frame sides of the carding engine. The peculiar feature of this new construction of segmental plate fixing is, that the united concentric straight-edges, which are placed and secured to it, partake of the same adjustment with the working roller and clearer.

The claim is, "the application and adaptation of the segmental plate fixing, containing the bearings of the clearer and the working roller; and also of supporting the united concentric straight-edges; and that the required adjustment of the roller *b*, and clearer *a*, to approach the main cylinder of the carding engine, may be more conveniently accomplished."

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To NICHOLAS WOOD, of *Hetton Hall, Durham*, and JOSEPH STOCKLEY, of *Newcastle-on-Tyne*, for improvements in apparatus for grinding, smoothing, and polishing plate glass.—[Dated 22nd January, 1863.]

THIS invention is intended to obviate the necessity for lifting the glass from the fixed grinding bench, and relaying it for each of the two subsequent processes of smoothing and polishing. It consists in constructing and using moveable grinding benches, capable of being transported to the apparatus for smoothing and polishing; thereby admitting of one side of the glass being finished in all the processes without relaying the glass in the manner required when the ordinary benches are used. The benches are constructed of the usual materials, with a smooth upper surface for the glass to rest upon, and are fitted into a frame provided with wheels, or sliding pieces, carried upon or in suitable rails or grooves, supported on the floor of the shop, upon which the benches may be moved in the direction required. Turntables, sidings, or sliding frames, are also used, to admit of the benches being drawn aside or changed, as required. The required progressive motion is imparted to the benches by means of racks and pinions. By thus making the bench on which the glass is first laid down a travelling bench, when one side of the glass laid thereon has been ground as required, the bench, with the glass thereon, may be removed to the smoothing machines, and subsequently to the polishing machines, without raising the glass from its first bed. The bench is not confined, as heretofore, to one portion of the machinery, but is capable of being removed from one to either or both of the machines for carrying on the other process or processes,—the bench either remaining stationary during the operation on the glass, or being moved backwards and forwards as required. When the glass is ground, smoothed, and polished on one side, it is turned over and passed through the several processes until its other side is finished.

The patentees claim, "the mode described of grinding, smoothing, and polishing plate glass, by means of travelling benches admitting of one side of the glass being operated upon throughout the whole series of processes, and finished before it is required to be turned."

To JOSEPH MOSHEIMER, of *Dolgelly, Merionethshire*, for improvements in machinery for crushing and grinding quartz and other substances.—[Dated 20th January, 1863.]

THIS invention consists in combining in the same machine the two principles of crushing and grinding quartz and other substances. First, the quartz or other substance is crushed by centrifugal force, and then it is ground fine by suitable grinding machinery.

In Plate IX., fig. 1 represents a vertical section of the improved machine, for crushing and grinding quartz, and fig. 2, is a plan in section of the crushing part of the machine. It will be seen that the water enters the machine by the hollow shaft *a*, as indicated by the arrow, and fills all the empty spaces at *n, n*, inside the grinding surfaces, and it is finally discharged at *o*, as shown by the arrows. The outside of the whole machine is also kept cool by water surrounding the grinder in the hollow jacket *p, p*. The machine is set in motion in the following manner:—*a*, is the driving shaft, on which is fixed the pulley *b*, which is driven by

steam or other power : to the shaft *a*, is fixed the bevil wheel *s*, gearing above in the wheel *s*<sup>1</sup>, fixed to the shaft *c*, and below in the wheel *s*<sup>2</sup>, fixed to the hollow shaft *t*. The lower wings *k*, *k*, of the crusher, and the grinders *l*, *l*, *l*, are fixed to the shaft *c*, and revolve in one direction, while the hollow shaft *t*, is turned in the opposite direction. To the lower end of the shaft *t*, is fixed the rotating wheel or wings *q*, *q*, of the crusher. By this arrangement, a double action of the wings *k*, *k*, and *q*, *q*, is produced ; for as the wings *q*, *q*, are placed above the wings *k*, *k*, and they run in opposite directions, if a piece of quartz be thrown by the lower wing it will be caught by the upper one and rebounded to the lower wing, or on to the flat revolving plate *u*, on which the wings are fastened, and so on continually until the quartz is reduced fine enough : it is then discharged through the sieves *r*. The quartz to be crushed is introduced through the hopper *g*, and passes through the opening *g*<sup>\*</sup>, from whence it falls to the revolving bottom plate *u* ; and by the centrifugal motion of this plate, all the particles are instantly carried to the outer part of the wings *k*, and then thrown against the fixed grooved sides *h*, or against the upper wings *q*, *q*, by which they are re-thrown in the opposite direction. On the revolving bottom plate *u*, are placed several punched sheet iron screens or sieves, through which the fine reduced quartz falls, and is conducted to the revolving grinders *l*, *l*, *l*, by passing between which and the stationary grinding surfaces *l*<sup>1</sup>, *l*<sup>1</sup>, *l*<sup>1</sup>, it will be ground as fine as may be required, and will then be discharged at the bottom through the openings *i*. At the bottom of the grinder shaft is a set screw *c*<sup>1</sup>, furnished with India-rubber plates, by which the grinders may be so set as to grind close and fine, and yet have some elasticity.

The patentee claims, "First,—the horizontal centrifugal motion of the wings *k*, and *q*, revolving in contrary directions, for the purpose of crushing quartz and other substances. Secondly,—the improved machinery for grinding quartz and other substances, with all its component parts. Thirdly,—the use of a continuous stream of water made to run through the centre of the hollow shaft, in order to keep the grinder and other parts cool. And, lastly,—the general arrangement of the machinery, as described, and every part thereof, as a new mode of crushing and grinding quartz, ore, and other minerals and vegetables, and animal substances."

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*To CHARLES HANSON GREVILLE WILLIAMS, of Glasgow, for improvements in the manufacture of red coloring matters.*—[Dated 29th January, 1863.]

IN order to produce a red coloring matter suitable for dyeing and printing, the patentee heats two equivalents of aniline, or its homologues, with one equivalent of phosphate or acetate of mercury. It is preferred that the aniline, or its homologues, should be in combination with acetic acid, as acetate of aniline (or of a homologue thereof) ; or it may be combined with hydrochloric, nitric, or sulphuric acid, as a hydrochlorate, nitrate, or sulphate ; or the aniline, or its homologues, may be employed in an uncombined state, or partly in the state of a salt and partly in an uncombined state.

The following is the manner of conducting the process :—The ingredients, having been mixed, are transferred to a still, having an agitator

within it, so as to keep the ingredients constantly stirred. The heat is then raised, by means of a steam jacket, to about  $240^{\circ}$  Fahr., and maintained at that heat as long as any water distils away. As much aniline is to be from time to time added to the contents of the still as is equal in bulk to the water distilling over, by which means the mixture is prevented from becoming too thick. As soon as the water has all been removed, the temperature of the still is raised to  $320^{\circ}$  Fahr., and, after two or three hours, is increased to  $360^{\circ}$  Fahr., by means of superheated steam. The heat is to be kept up as long as the color of the mixture appears to increase in intensity. The time required for the whole operation is generally about forty-eight hours. The thick treacly mass remaining in the stills is to be distilled with water, to recover the aniline unacted on, and the coloring matters may be precipitated from the aqueous solution, by means of common salt.

The patentee also obtains a red color, suitable for dyeing and printing, by heating a salt of aniline, or its homologues, such as the sulphate, hydrochlorate, or nitrate, with uncombined aniline and arsenious acid. He mixes together, in an enamelled iron or earthenware vessel, one equivalent of sulphuric, muriatic, or nitric acid, with two equivalents of water; then adds three equivalents of aniline, or its homologues, and one equivalent of arsenious acid. This mixture is transferred to a still with an agitator, and the rest of the operation is performed in the same manner as has been previously described for the phosphate or acetate of mercury and a salt of aniline.

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## Scientific Notices.

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### INSTITUTION OF MECHANICAL ENGINEERS.

(Continued from page 240.)

The next paper read was, "*A description of a hydraulic shears and punch*," by Mr. JAMES TANGYE, of Birmingham.

THE object of this hydraulic shears is to afford the means of readily cutting large sections of bar iron or railway rails, by the power of one man only, and with a machine of simple and compact construction.

The shears consists of a strong vertical cast-iron frame, divided in the centre horizontally: to the upper half the upper shear blade is fixed; and a short hydraulic press is cast in the lower half of the frame, having the lower shear blade fixed upon the top of the ram of the press, which is 10 inches diameter with three inches length of stroke. The upper and lower castings of the frame are secured together by two bolts of 3 inches diameter. A box, bolted upon the side of the cylinder, contains the force pump, and serves as the reservoir for the water of the pump. The pump, which is worked by a hand lever, consists of a single brass casting, screwed into its place in the side of the hydraulic press. It contains a small conical suction valve and delivery valve,

$\frac{1}{2}$  inch diameter, held down to their seats by spiral springs. A small wire-gauze guard is fixed over the outside of the inlet and outlet openings of the pump, to prevent any dirt from getting into the press cylinder. The plunger,  $\frac{3}{4}$ -inch diameter and  $1\frac{1}{4}$ -inch stroke, is continued backwards, to work in a guide socket in the end of the reservoir, and a tongue on the shaft of the hand lever, works in a square slot in the plunger rod.

The lower shear blade is lowered after the cut by means of a self-acting motion connected with the force pump lever. The length of stroke of the lever is limited in ordinary working by a stop pin fixed on the side of the cistern, which catches the lever at the bottom of its stroke; but by shifting the lever  $\frac{1}{4}$  inch outwards upon the square end of the shaft, it is made to clear this stop pin, and is pushed down into a lower position. The prolonged end of the plunger then reaches the delivery valve of the pump and presses it open, allowing the water to flow back from the press cylinder into the pump; and at the same time the water is allowed to flow through the centre of the plunger by a hole drilled through the entire length of the plunger. This hole is closed at the outer end by a conical escape valve opening outwards, which is kept shut in ordinary working by the tongue of the hand lever; but, when the lever is depressed below the stop for lowering the shears, a recess in the tongue is brought over the head of the escape valve,—allowing the valve to be forced back from its seat by the water pressure, and leaving a passage open for the water to escape through the hole in the plunger back into the cistern. The act of raising the hand lever again into its working position closes the escape valve, and keeps it shut during the working of the pump. A second force pump of larger size, with 2 inches diameter of ram, is used to bring up the shears quickly to the work to be cut.

With this shears a bar of wrought iron, 3 inches square, is readily cut by one man, the time required being about  $2\frac{1}{4}$  minutes. Different sizes of the shears are made for cutting bars up to  $3\frac{1}{2}$  inches square; the smaller sizes of bars being cut off several at a time.

This hydraulic shears is found very useful in iron warehouses for cutting large bars, where the power of only one or two men is available; and also on railways for cutting the rails, for which purpose the shears can be readily carried on an ordinary platelayer's lorry, no other foundation being required, and the whole weight being only 14 cwts. In the case of cutting rails, the shear blades are made of the same shape as the outline of the two sides of the rail, so as to cut the whole section at once, and make a clean square cut.

The hydraulic punch is of similar construction to the shears already described, only inverted in arrangement, having the fixed die at the bottom, and the punch fixed on the end of the inverted ram of the hydraulic press, which is 6 inches diameter, with 2 inches length of stroke. The box containing the force pump, and reservoir of water, is fixed on the side of the press cylinder at the top. The punch is withdrawn quickly after the stroke by means of a spiral spring pulling up the ram; the water being allowed to escape back from the press cylinder to the cistern through the centre of the plunger, by the same means as in the shears already described.

With this punch a hole 1 inch diameter is punched in a  $\frac{3}{4}$ -inch iron

plate, with the power of one man, in about half a minute. The machine is very portable, the total weight being only  $4\frac{1}{2}$  cwts.; and it has been applied with advantage to punching the holes for fish bolts in railway rails. A successful application of this machine has also been made to the manufacture of horse-shoes, by punching them out cold, with the holes and countersink complete, at one operation.

An hydraulic lifting jack is also constructed on the same plan as the shears and punch, as regards the force pump. The jack consists of an inverted hydraulic press, the ram of which forms the foot upon which the jack stands, and the pump and reservoir of water are fixed on the opposite end of the press cylinder, and form the head of the jack. The ram is of wrought iron,  $3\frac{1}{4}$  inches diameter and 12 inches length of stroke, with the foot forged upon it; and the press cylinder is formed of a hammered wrought iron bar, bored out of the solid, leaving  $\frac{1}{8}$  inch thickness of metal for the sides of the cylinder. A claw is forged on one side of the cylinder at the bottom, for the purpose of using the jack to lift from the bottom when required. The head forming the reservoir of water is of malleable cast iron, fixed upon the top end of the cylinder by being bored out a tight fit and pressed on up to a shoulder.

The jack is lowered by similar means to that previously described for the shears and punch; except that instead of the water escaping through the plunger, the suction valve is forced open by the same movement that presses open the delivery valve, by means of a small inclined plane upon the prolonged end of the plunger, which passes through an eye in the stalk of the suction valve, and draws back the valve from its seat directly after the delivery valve has been pressed open, allowing the water to flow back into the reservoir in the contrary direction to the ordinary working.

The ram of the jack is packed with a cupped leather, resting in a hollow,  $\frac{3}{16}$  inch deep, turned in the top of the ram. These leathers have been found thoroughly successful in standing the pressure and wear; the same leathers having been in regular work for several years without requiring renewal. The force-pump plunger in the lifting jack, and also in the shears and punch, is packed with a narrow strip of leather  $\frac{3}{16}$  inch wide, coiled round spirally in a groove turned near the bottom of the plunger, with the ends of the strip bevilled off to fill up the groove close.

The hydraulic jack described was made for lifting 30 tons, but several different sizes are made for weights from 4 to 60 tons. The head of the jack is prevented from turning round by a sliding block working in a longitudinal groove in the ram; but by withdrawing the screw that fixes the block, the head is allowed to turn freely with the load upon it. The hydraulic jack is convenient for use with heavy weights, from the great power obtained,—one man being able to lift readily 30 tons and upwards,—and from the lightness of construction,—the 30-ton jack weighing only about  $1\frac{1}{2}$  cwts. At the same time the loss of power from friction is comparatively small; and the small extent of wear to which the working parts are subjected, gives great durability and freedom from risk of derangement.

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29th January, 1863.

CHARLES F. BEYER, Esq., IN THE CHAIR.

The first paper read was, "*On the apparatus used for sinking piers for iron railway bridges in India*," by Mr. JOSEPH F. STRONG, of Allahabad.

THE general mode adopted for forming the foundations for railway bridges over the large Indian rivers, is an application of the old native plan of sinking cylinders or wells of brickwork, by excavating the sand from the interior of the cylinders, and allowing them to sink by their own weight,—increasing the height of each cylinder successively by additional brickwork, until it has sunk to a sufficient depth to obtain the required hold in the ground. This plan has been in use for ages in that country for forming the foundations of the native forts on the banks of rivers, and also for sinking wells for water. In the case of the railway bridges, the same plan is extended, by being carried out upon a larger scale, to obtain a greater depth, and consequently greater stability of foundation. Sets of brick cylinders, varying in number from 3 to 12, and in diameter from 18 to 8 feet, based upon wrought iron or wood curbs, are sunk to a sufficient depth in the ground to form the foundations for each pier.

The bridge of which the foundations are described in the present paper is on the main line of the East Indian Railway from Calcutta to Delhi, and spans the river Jumna at Allahabad, about  $1\frac{1}{4}$  mile above its confluence with the Ganges. It is composed of 14 openings, of 205 feet clear span each, crossed by wrought-iron girders, and giving a total waterway of 2875 feet; the distance between the abutments being 3075 feet. The height of the top of the piers is 58 feet 6 inches, and of the rails 80 feet above low-water level. For the foundations of the bridge, ten brick cylinders, of 13 feet 6 inches diameter, are employed in each pier, sunk to a depth of 43 feet below the low-water level.

The Jumna, like most of the Indian rivers, winds about much in its course, and varies in width and depth considerably; and within a distance of three quarters of a mile above and below the railway bridge it is 65 and 72 feet deep respectively at low water; but this depth is reduced to only 15 feet at the spot selected for crossing, by the chief engineer, Mr. Edward Purser. A number of experimental brick cylinders were sunk, to ascertain what the bed of the river consisted of, and at a depth of 35 feet, nothing but sand, partly mixed with clay, was found. Generally speaking, the water is so low in the Indian rivers between the months of November and May, that there are no great difficulties to be got over in beginning operations for sinking the cylinders to form the foundations of the piers; but in the Jumna, which is never dry, it was unavoidable that the piers had to be begun where there was deep water; and as the means of pitching iron curbs under water were not at hand, the question arose what was the best mode of commencing the building of the cylinders preparatory to sinking them.

The simplest plan seemed to be, to form an artificial island for each pier; and this was done in the following manner. Taking the centre of a pier in 15 feet depth of water as the starting point, and setting

out a space of 175 feet length by 120 feet width, sand bags were sunk on the down stream and two adjacent sides, thus forming three sides of an enclosure, in the centre of which loose sand was thrown, which was carried by the stream, and deposited against the upper side of the lower boundary of sand bags, where it formed a ridge: in due course the surface of the water was thus reached, when the sand was all thrown on the up-stream side, and an island was thereby speedily formed, 100 feet long by 60 feet wide at the top. On this island the ten iron curbs were pitched, to form the bases for the ten brick cylinders composing the foundations of the pier; being pitched at a distance of 15 feet 6 inches, centre to centre, transversely of the pier, and 15 feet longitudinally.

The iron curb is 13 feet 6 inches diameter outside, and 8 feet 6 inches inside; the interior of the brick cylinder diminishing from the curb to 6 feet 9 inches diameter. The curb consists of a flat horizontal ring of  $\frac{3}{4}$ -inch boiler plate, 2 feet 6 inches wide, rivetted by an angle iron to an outer cylindrical ring of similar plate, 18 inches deep, and having gusset plates connecting the two rings underneath. The outer cylindrical ring extends 3 inches above the horizontal one, forming a support all round to the base of the brick cylinder on the outside; and an angle iron upon the inner edge of the flat ring forms a similar support within. To keep the curbs in place, they are sunk till the top plate of the curb is bedded on the sand; then 12 feet height of brick-work, 3 feet  $4\frac{1}{2}$  inches thick, is built upon the curb, the first 5 feet of which is sunk by simply taking out the sand from the under side of the curb by hand; after which a different plan of sinking has to be adopted.

The implement generally used for getting out sand, &c., in deep foundations in India, is called a "jham;" it has been known and used by the natives for ages in sinking wells for water, and also wells for foundations of river forts, quay walls, &c. The jham is a large scoop, something in the form of a large hoe with a short handle, which the natives invariably make of wood, simply having the cutting edge shod with iron. The plan of working they adopted was to send down divers into the water in the interior of the brick cylinder, who with the jham loosened the sand or clay at the bottom; then the diver filled the jham with the loose materials, and was hauled up with it out of the water. This implement was, in fact, never employed by the natives without the aid of divers, who did the excavating work with the jham itself; they are expert in the use of it, remaining under water regularly about a minute each time of diving. Even in foundations for road bridges, built under the direction of government engineers, the jham has been used only in conjunction with divers; and also on the Madras railway (as has been elsewhere described by the chief engineer, Mr. G. B. Bruce), the same means were employed in sinking the brick cylinders for the foundations of the river bridges; the rivers being in that case comparatively small and shallow, and quite dry in the working season.

It is evident that a stronger and more efficient apparatus was needed to sink cylinders 43 feet deep below the water level, through dense sand, as in the case of the large Jumna bridge. The results of numerous trials with many kinds and forms of the tool gave a jham of wrought iron; there being attached to a stem or arm a scoop 2 feet 2



inches wide and 2 feet 4 inches long, made thin and sharp at the front edge, and supported by two stays, fixed to the sides of the scoop and also made thin and sharp at their front edges for penetrating the ground readily; the whole weighing about  $\frac{3}{4}$  cwt.

The mode of using this jham is as follows:—By means of a couple of ropes attached to the tail end of the stem or arm, the jham is lowered by hand to the bottom of the well, till the cutting edge of the scoop and the outer end of the arm rest upon the sand. With the weight of two or three men bearing on the top of a vertical pole, which is held in place by a pin at the bottom passing loosely through a hole in the tail end of the arm, the scoop is forced into the ground. It is then raised a short distance by ropes; the outer end of the arm resting upon the sand and forming a sort of centre of motion: the scoop is now dropped with the weight of the men bearing upon it, and its cutting edge is thus forced into the sand. By repeating these strokes, the scoop is forced into the ground a considerable depth; the workmen knowing by the feel when the scoop is deep enough in the sand. Then, with the weight of the men still on the vertical pole, the jham is hauled up by means of a windlass, round the barrel of which a chain is wound that is attached to the extremity of the arm; the jham being thereby tilted until the scoop takes a horizontal position. The jham is then brought up filled with sand. It requires ten men at the windlass to move the jham when bedded in the sand, and lift the scoop to the horizontal position: it is then drawn up to the top, emptied, and the process repeated.

After the first length of 12 feet of brick cylinder has been sunk down to the water level, an additional 15 feet is added; and the process of sinking continues till the 15 feet added has been sunk, when an additional 16 feet is added, making a total of 43 feet depth. As a precaution for preventing the curb and lower portion of the brick cylinder from parting from the upper portion, in consequence of the latter being held by the friction of the sand being greater at that part, which is found sometimes to occur, provision is made on the curb for attaching six holding-up bolts, which are built into the brickwork for a length of 16 feet; and at intervals of every 5 feet a ring of flat iron is dropped over all the bolts and cotted down on to the brickwork.

The rate of sinking of the cylinders is far from regular: at starting the progress is pretty even, the cylinders going down from 15 to 9 inches per day; but the average rate of sinking, when down to 20 feet, is not more than  $4\frac{1}{2}$  inches per day; and beyond that depth, the rate of progress gradually decreases till it is not more than  $1\frac{1}{2}$  inch to 1 inch per day of 24 hours. The plan that is adopted where the sinking goes on slowly, is to add extra weight on the top of the cylinder, either by building extra brickwork or adding a load of rails. In very bad cases both means are used, till a weight of 40 tons on each cylinder has been added; and even with this additional load on the top, great difficulty has been met with when the sinking has reached a depth of 40 feet; which is not surprising when it is considered that there is then a constant pressure due to 40 feet head of water acting upon the sand round the exterior surface of the cylinder at the bottom.

When the cylinders have been got down to the depth of 43 feet, they are ready for the concrete; but before throwing this in, a diver, supplied

with Siebe's diving apparatus, is sent down to clear away any rubbish that may be left at the bottom of the well, and level the space under the curbs for the reception of the concrete. A depth of 15 feet of concrete is then thrown in, composed of 1 part of fresh-burnt unslacked lime, 1 of broken bricks, and 2 of under-burnt lime: these are the usual proportions of the concrete used in stopping the cylinders, and about 18 days are generally allowed for it to set. A disc, made of two thicknesses of 2-inch planking, is let down upon the surface of the concrete, weighted by 3 feet thickness of brickwork; this disc is a little less in diameter than the inside of the cylinder, so as to pass freely down on to the concrete; the space between the edge of the disc and the sides of the cylinder being then filled in with wood wedges driven by divers. The object of putting in this disc is to prevent the concrete being disturbed by the pressure of water underneath, whilst the water is being baled out from above the concrete, preparatory to building the cylinder up solid.

The lime used in India is peculiar, and is called "khunkur." It is picked up in the beds of rivers and small streams after the rains, and is found sometimes in isolated beds; but generally it is in detached masses composed of pieces of about the size that stone is broken for metalling roads. It is of a light-grey colour, and is burnt in the usual way, either in heaps or in kilns, the latter being preferred; and the per-centage obtained is generally about 55 per cent. The mortar used is generally made of 1 part of lime to 1 or  $1\frac{1}{2}$  parts of "soorkhee," which consists of bricks pounded and passed through a sieve of 8 meshes to the inch; this mortar is of the best description, being hydraulic, and setting almost better in water than out of it. No sand is found in India sufficiently sharp for making mortar; hence the use by the natives in the first instance, and now by Europeans, of brick-dust, as it may be called, in place of sand for making mortar.

The next operation, after having made tight the wood disc upon the top of the concrete, is to bale out the water and build up the void inside the cylinder solid with rubble stone; this is carried up to the top of the cylinders, and their tops are thus reduced to an even bed ready for the covering stones. As a precaution, to prevent these stones from spreading, a groove is cut in the top of the cylinders 6 inches deep, and extending lengthways of the pier; into this groove the large stones are laid, and they stretch across the space between the cylinders, and have a good hold on each cylinder. The stones are all cramped at the joints with  $1\frac{1}{4}$ -inch square iron, and the stones in the next course above are dropped into joggles in the first course. The hearting of the cylinders is then carried up in brickwork, diminishing by a set-off of  $2\frac{1}{4}$  inches at each course, to form a core or centre for the corbelling or over-sailing of the brick steining of the cylinders. A similar provision is made on the outside of the cylinders by throwing in concrete between the cylinders, and building concentric rings of brickwork upon that: over these the corbelling on the outside of the cylinders is carried. There are twelve courses of brickwork between the top of the cylinders and the top of the second course of the covering stones; and at this level there is a through or bonding course of ashlar, running transversely to the piers. Up to the top of the plinth there are similar courses faced only with ashlar, the backing or hearting being large rubble. The piers

between the plinth and cap are built with ashlar facing to the cutwaters, blocking courses between the shoulders of the cutwaters, and rubble backing behind, throughout the whole length of the piers. There are large stones for carrying the cast-iron bed plates, upon which the saddles supporting the end standards of the bridge rest.

Only one line of rails is at present in process of construction, though all the piers and abutments are made complete for a double line of rails. The girders are wrought-iron trusses, designed by Mr. George Rendel, in principle something like a double Warren truss; the railway being carried upon the top, and a public roadway upon the bottom of the girders. The girders are constructed with a rectangular box at the top and flat tension bars at bottom: the vertical struts are plain bars, with double angle irons, and are clipped between the transverse flanges of the top box; the diagonal ties are flat bars. In the construction of the girders all the holes are drilled, none being punched. The weight of the pair of girders for one span is, for the length of 210 feet between the supports, 288 tons, including the cross girders, but exclusive of the covering of the roadway and railway, being a weight of  $27\frac{1}{2}$  cwts. per foot run.

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Mr. Strong exhibited a model of one of the brick cylinders for forming the bridge piers, showing the construction of the wrought iron curb and the mode of building the brickwork upon it; and also a model of the scoop and windlass used in excavating within the cylinders. He stated that the clay met with in sinking such rivers as the Jumna was not hard like ordinary brick clay, but was nearly always mixed with sand, and consequently was not close enough to keep out water: there was also not sufficient depth of clay for the purpose. The cost of sinking each separate cylinder by this plan was 10s. per foot down to 5 feet depth: between 5 and 10 feet it was 20s. per foot; between 10 and 15 feet 30s. per foot, and so on, increasing regularly 10s. per foot at every additional 5 feet of depth, down to 40 feet depth, beyond which the rate was 90s. per foot. Those were the rates paid to the men for labour only, the materials being found for them. The work was all done by contract: one contractor undertook the sinking of one or more cylinders at those rates, and paid his own men.

Mr. H. W. Harman thought the cost of the sinking at that rate would be greater than by the use of screw piles. He enquired whether all the cylinders in one pier were sunk simultaneously, or whether they would interfere with one another if sunk together.

Mr. Strong replied, that all the cylinders were sunk together in one pier, as it was easier and much quicker work to sink them all together. The only failure there had been occurred during the high floods of 1861, when the four up-stream cylinders out of the ten in one pier, fell over. This was owing to the sand inside the cylinders having been scooped out in the process of sinking to as great a depth as 18 feet below the curbs; so that the cylinders were hanging as it were in their places, held up only by the friction of the sand outside. When the flood came down, and the water began to eddy round the cylinders, the sand was set in motion, and gradually loosened round them; and eventually, the support being taken away from them, they slipped

down, and in so doing quietly fell over on their sides. It was subsequently ascertained, by probing with steel rods, that the convex side of the cylinders was unbroken: they had simply fallen over, but had not broken to pieces.

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The next paper read was, "*On a type composing and distributing machine*," by Mr. WILLIAM H. MITCHEL, of London.

ALTHOUGH the process of printing from moveable types has, by the power press, been accelerated a hundred fold, the art of composing the types in order to be printed from has not advanced a step since Guttenberg's time. About 50,000,000 of letters are daily composed and distributed in the United Kingdom, and every one of these is picked from a box by the fingers, and afterwards returned to it in the same manner, without any sort of mechanical aid. Nevertheless, during the last twenty years fully twenty attempts have been made by English, French, German, Danish, Italian, and American inventors to effect an economy in this direction. Three inventors died recently, after devoting seventeen and eighteen years respectively to this subject, and have left the eventual introduction of machinery for composition still a question, and one which printers in general yet decide in the negative. In order to appreciate the efforts of these numerous inventors, it is necessary to have a clear idea of the nature of the work to be performed.

The work of the compositor may be divided into five operations:—Composition, Justification, Making up, Correction, and Distribution. *Composition* consists in picking up one by one the various letters or "sorts," out of a wooden tray divided into compartments, called the "case;" and laying them together in line in the order required to form words, with small blocks or blank spaces of a uniform size between the words. As, however, all the lines of a page must be of the same length, and as all words do not consist of the same number of letters, and all letters are not of the same thickness, the lines have to be made to correspond in length, either by dividing a word, or, when that is not possible, by increasing or diminishing the spaces between the words. This is called *Justification*, and in performing it, the compositor begins to measure by eye the length remaining to be filled as the composition approaches the end of the line, and the words to be put into it, and inserts accordingly either larger or smaller spaces between the words. The spaces thus inserted, however, must not be out of proportion to an unsightly extent with those already in; and hence it generally happens that, notwithstanding all the previous care in composing, some of the work at least has to be gone over again, the spaces already in being taken out and others put in: and the final tightening of the line in the "composing stick" is done altogether by trial. *Making up* is the dividing of the composed matter into pages of a given number of lines, and does not specially concern the present subject. The same remark applies to *Correction*. Lastly, *Distribution* is the process by which the types, after being printed from, are returned each to its proper compartment in the case, ready to be again composed in new combinations. It consists in taking with the finger and thumb of the right hand eight or

ten letters from a block of matter held in the left, reading them, and then dropping them successively into their several boxes, which operation is repeated till the whole work is distributed.

These five operations represent the work of the compositor in about the following proportions :—

|               |     |     |              |
|---------------|-----|-----|--------------|
| Composition   | ... | ... | 55 per cent. |
| Justification | ... | ... | 17 "         |
| Making up     | ... | ... | 7 "          |
| Correction    | ... | ... | 7 "          |
| Distribution  | ... | ... | 14 "         |

Of these processes, justification, making up, and correction, have never been attempted by machinery. The fifth, distribution, is already very rapidly effected by hand, so that not much scope is left for saving of labor; but inasmuch as all composing machines require the letters to be primarily disposed in lines ready for setting up, it has been found necessary to use machinery to distribute them in that manner: this is however an accessory and not a principal point. There remains only composition,—that is the mere setting up of the types, in which to effect economy. To this, therefore, and to the accessory process of distribution in line, inventors have directed their efforts, leaving the other processes to be done in the ordinary way.

It is, of course, impossible to construct self-acting machinery capable of setting up types; for the matter to be set up varies infinitely, while a machine can produce only a uniform result, the conditions remaining the same. And since a guiding intelligence is needed, the question became, on what kind of apparatus could this intelligence act most rapidly, so as to produce a series of motions, simple in themselves, but occurring in a perpetually varying series? The obvious answer was, "finger keys," and accordingly all composing machines have been constructed with finger keys. But here a difficulty presents itself. The number of sorts or characters, for each of which a type reservoir and key must be provided, ranges from a minimum of forty to a maximum of more than two hundred. The space required, therefore, makes it necessary to place some at least of these type reservoirs at a considerable distance from the point at which the letters must meet to form words. Over this distance the types cannot be carried directly by the action of the key, without giving the latter so much to do as to make the fingering stiff and awkward. A secondary means of conveyance from the separate type reservoirs to the common receiver has, therefore, to be provided, which must be so arranged that the letters, from whatever distance, will arrive at their destination in the same order in which the keys are touched. As this is the main requirement, the manner of attaining it generally prescribes the character of the details, and may be taken as the distinctive feature of the different inventions for the purpose.

The different constructions of composing machines may be divided into two classes:—those in which each letter is, by a rapid motion, carried to its destination before the next letter is liberated; and those in which several letters may at the same time be travelling, by different routes, towards the point of setting up; the means of transit being so arranged, with regard to time or distance, that the letters shall arrive at their destination in their proper order. To the first class belong

Beaumont's and Loughborough's machines, in which the carrying is performed by an arm rotating rapidly in a horizontal plane; the type reservoirs and the receiving line both forming produced radii of the circle described by it, and the action of the key being to bring the type within the sweep of the arm. The second class comprises the machines of Sørensen, Rosenberg, Young, Hattersley, and Alden, together with that forming the subject of the present paper.

The composing machine forming the subject of the present paper combines Rosenberg's method of carrying the letters by endless bands, with Young's idea of so arranging their route that all will take an equal time to reach the receiver.

The general arrangement of the composing machine is in a horizontal plane, and in shape it resembles a triangular table. The table is traversed by a series of parallel endless bands, the return side of the bands passing underneath. These bands are all made to travel with an equal and uniform velocity, by passing round the same shaft. Obliquely to these, and at a somewhat lower level, a collecting band skirts the machine diagonally. Above the parallel bands stands a row of the type reservoirs or slides, one band passing under each reservoir. The keyboard extends along the front of the machine, each key communicating with the type reservoir directly in front of it. When the types are liberated from their respective reservoirs by the action of the keys, they drop on the parallel bands, which deliver them on to the diagonal collecting band, and this in turn carries them to the receiver or setting-up wheel.

The parallel bands travel at the rate of about six inches per second, and the diagonal collecting band at fifteen inches per second. The object of this peculiar arrangement of the bands is, that all the letters may take an equal time for their transit from the reservoirs to the receiver. Although there are forty reservoirs, and no two are at the same distance from the receiver, an equal time of travel for each type is obtained by the use of these two velocities only. The route of each letter is made up of two parts—one on the slow band, and the other on the fast band; and the proportion of these parts varies with the whole distance, so as to give in every case a mean velocity proportionate to that distance, so that the actual total time of passage is the same for each type. In the hands of a swift operator, before the first letter of a sentence has reached its destination, twenty or thirty more are already on their way; and although they seem to be in confusion while on the parallel bands, they resolve themselves into a string as they fall upon the diagonal collecting band, with intervals of about  $1\frac{1}{4}$  inch between each of the types.

The type reservoir is a channel or slide of sheet metal, inclined at an angle of about 55 degrees. It is made with an eye at the back, to fit on a pin in a bed piece cast in type metal. These bed pieces are made to fit into a grooved bed plate, and overlap one another so as to hold in a recess the small steel stop plate, which serves as the stop for the types in the reservoir. When the types are brought up by the stop, the lowest has already passed out of the slide, but is prevented by friction from falling out. The finger key is attached to a rocking shaft, carrying at the end next the type slide an arm, on which is a small shank, parallel with the rocking shaft, On this shank is placed a

striker, formed as a tube fitting freely on the shank, and having flanges projecting from it on each side of the stop, to take the type. The striker is brought up against a stop on the rocking-shaft arm, by a light India-rubber spring. When the key is depressed, the striker is caused to descend, and force the type downwards, until it is clear of the stop, when the type falls upon the endless band below. The types in the reservoir, overcoming by their weight the resistance of the India-rubber spring that holds up the striker, descend at once upon the stop, forcing the striker backward. The key being now released, the striker rises and recovers its former position by means of the India-rubber spring. One of the advantages of the yielding striker is, that the spring used to raise the depressed key may be weak, not having to overcome much resistance in raising the key: this is a point of great importance as regards rapidity of fingering.

The types thus liberated from the type reservoirs are immediately carried on towards the diagonal collecting band, on which they are delivered by a sort of curved spout.

The diagonal collecting band carries the types to the receiver, which sets them up in long lines by a kind of ratchet wheel, formed of successive thin steel plates with discs of sheet metal between, resembling a number of circular saws revolving backwards,—the teeth forming the supports for the types. On the circumference of this wheel, at a point nearly over the centre, the types are delivered by means of a small shoot, and, slipping into the ratchets, are carried round into a vertical position, when they are caught by small steel fingers placed in the interstices between the steel plates of the ratchet wheel; the following ratchet teeth, then acting as clams, push the types along as part of the line composed. The shoot and wheel are tilted slightly, causing the types to hug the lower side; and the wheel has one plate of larger diameter on that side, serving as a fence to prevent the types from falling off. The other side of both wheel and shoot is left open, so that if two keys should be touched at the same time, or any other accident should cause two letters to arrive together at the setting-up wheel, one is thrown off, and no choking takes place,—the type thrown off being caught in a tray fixed below.

The lines of type composed in this manner pass out upon a long moveable rod, which, when full, is emptied on a kind of desk with ledges, where it is justified. This is done in the ordinary way, except that the lines are lifted into the compositor's "stick" with one hand, by means of a grab of sheet metal, slightly curved, having one end hooked and a lug at the other end. The lug being laid hold of by the forefinger, and a slight pressure exerted by the thumb upon the end of the line of type, the latter forms itself into an arch in the grab, and may then be lifted without risk of falling to pieces. This is done very rapidly with a little practice. The types once in the composing stick, which is of the usual pattern, the remaining parts of the process—justification, making up, and correction—are performed by the compositor in the ordinary manner.

This new method of composition makes it necessary to adopt a new plan also for storing the type, the old cases being no longer of any use for that purpose. For the composing machines, the letters must always and under all circumstances be kept arranged in line. When in store,

therefore, they are placed on thin wooden slats, 13 inches long, so formed, that a number of them charged with type may be laid together, or lifted together. These slats are placed on racks under the composing machine; and in feeding the machine, the lines of letter are slipped sideways off the slats into the type reservoirs of the machine.

This composing machine is capable of setting up types at the rate of 6 letters per second, or 21,600 per hour; but as the compositor's fingers cannot attain to such rapidity, and allowance has to be made for the operations of justifying and correcting, the work of an average trained compositor will probably not exceed 24,000 or 25,000 letters per day, which is about equal to the work of two men setting up type by hand in the ordinary mode. Each composing machine can employ two men, making the daily production about 50,000 letters with one machine.

When the composed matter has returned from the press, all that remains is to distribute the various types into separate receptacles, and replace them on the store slats, so that they may be used again in the composing machine. The first step is to place several lines of a page end to end, so as to form a single long line of letters, in which form they are fed into the self-acting distributing machine. The long line of letters is placed in a horizontal feed channel, in which they are drawn forwards, as successfully distributed, by a follower, operated by a weighted string. At the mouth of the feed channel they are cut off singly by a vibrating striker, and fall into grooves cut in the circumference of a conical distributing wheel, which revolves horizontally at a slow speed beneath. This wheel revolves above a stationary base, also conical,—the two forming together a frustrum of a cone. At the lower end of each of the 60 grooves in the circumference of the distributing wheel is a small pin, on which the types, as they fall through the grooves, become suspended by means of nicks cut in their sides, but not until their lower ends have passed a short distance out of the grooves, so that the foot of the type projects over the surface of the stationary base. As the nicks are cut in different positions in the different letters, some types project further from the grooves than others, and so descend further over the surface of the conical base. On the base is fixed a series of offsets, each presenting a horizontal incline to the lower ends of the types, as these are carried round by the distributing wheel; and when the foot of a type comes in contact with one of the offsets, it is canted outwards by the incline, until the nick by which the letter hangs becomes clear of the suspending pin; when the type drops into one of a series of radial receiving lines in the stationary base, and is immediately pushed forwards along the line, to make room for others.

The offsets are arranged in a series of steps, ascending in the direction of the distributing wheel's motion, each being fixed a little higher up on the base, and therefore nearer the conical wheel than the one behind it. Consequently those letters which project the furthest below the grooves of the distributing wheel are first brushed off, and the rest follow in due succession. As all the letters are thus removed in the course of one revolution of the wheel, the grooves return empty under the feed channel, to be again filled; and so the distributing wheel goes on filling, emptying, and re-filling itself, till the line of letters to be



distributed is exhausted. The receiving lines extend outwards radially, and are 13 inches long, each having a small loose sliding block, to keep the types upright in a line. As each line fills up with its appropriate letter, the contents are slidden out by the attendant on to a brass rod, dumped on the store slats, and placed on the racks under the composing machine, ready for use again in composing.

The first difficulty in the distributing machine was to find a means of cutting off the letters one at a time from the feed line, as they often adhere strongly together with printing ink, and are, moreover, of many different thicknesses, some being five times thicker than others. This is effected by the following contrivance. The feed line, when drawn forwards in its channel, is brought up at the end of the channel by an inclined stop, formed of a small steel plate, projecting a short distance across the mouth of the channel, and placed at an angle of 45 degrees to its bed. When a thin letter is foremost, the advance of the line is arrested by the upper edge of the stop plate, which is sufficiently far in advance of the channel mouth to permit all types under a certain thickness to clear the channel. But in all types above this thickness a nick is cut in the side of the type, into which the upper edge of the stop plate passes; and the advance of the line is then checked, not by the upper edge of the stop plate, but by the lower side of the nick coming in contact with the under sloping face of the plate. The point at which the type is arrested depends, of course, upon the distance the nick extends downwards in the type, and this distance is always made proportionate to the thickness of the letter. In this manner every letter, of whatever thickness, is permitted to pass out just clear of the feed channel mouth, and is then cut off by the vibratory motion of a striker, without danger of carrying another letter with it.

In order to prevent any injury being occasioned by accidental sticking of any of the types in the grooves of the distributing wheel, a stop action is provided for stopping the motion of the machine immediately; which prevents the wheel from damaging the type, or receiving any injury itself.

The distributing machine requires only the attention of a boy, and distributes 8000 letters per hour.

The nicks in the types required for the distributing machine are cut in them by means of a plane with three cutter heads, admitting of all the nicks being cut at once. The adjustments for giving the nicks their proper positions are simple and easy, and either new or old types are nicked, usually at the cost of one penny per lb.

The number of characters provided for in the composing and distributing machines now described is limited to about forty. This seems at first a serious defect, inasmuch as the number of characters required even for plain work—counting roman capitals, small capitals, italics, and numerals—amounts to about two hundred. The small number of forty was adopted, however, from calculation, and not from necessity; for the distributing machine is susceptible of considerable extension, and the composing machine of any desirable extension. But in any work otherwise adapted to the machines, the 160 excluded sorts really amount to only from two to five per cent. of the entire matter; and in consideration of the necessarily complicated character of the mechanism, and the moderate saving to be hoped for at

the best, it was thought better to dispense with an extension which would double the cost of the machines while adding but 5 per cent. at most to their efficiency. The extra sorts are therefore placed in a case in the composing machine, and are dropped by hand into a shoot as they occur, passing along on the endless bands with the other types to the setting-up wheel: while in the distributing machine, these extra sorts, having no suspending nicks in them, drop off the distributing wheel, at the commencement, into a separate receptacle, and are then distributed by hand. The composing machine is usually constructed to work three different sizes of type without adjustment; and the distributing machine is capable of adjustment, with a change of the distributing wheel for each size of type.

The economic bearing of these composing and distributing machines, and the results actually obtained in work done where they have already come into use, remain now to be considered. Of the numerous inventions for the same purpose that have been brought forwards at intervals within the last twenty years, some were the subject of much attention; and several were for a time at work, more or less experimentally, but afterwards fell into disuse. And in the case of the machines now exhibited, their progress during the nine years they have been in existence must be regarded as extremely slow. It might have been expected, from the undoubted advantage possessed by finger keys over the hand picking-up process, that a saving would be effected large enough at once to overbear all objection, and lead to the speedy and general introduction of the machines. But this is not the case. The saving has never exceeded 50 per cent.,—diminishing under less favourable circumstances to little or nothing; while the difficulty of adapting the new method of composition to the present conditions of printing has been very great. That the saving falls short of what might be anticipated is owing to the circumstance that the work of the compositor consists, as already stated, of several distinct operations, some of them susceptible of mechanical aid, but others either not susceptible or hitherto unattempted. What makes the difficulty greater is, that it is not easy to separate one operation from another. For instance, it is inconvenient to charge one compositor with the justification or correction of work composed by another: consequently it is impossible to introduce that division of labour indispensable for obtaining the full benefit of machinery. The compositor has thus to pass from one operation in which he is assisted by mechanism to others which are purely manual; and one result of this shifting about is that the machine stands idle about one-fourth of each day. A still more serious result is the waste of time inevitable wherever there is frequent changing from one process to another. The mere setting of the types in line, in which alone a saving is effected, amounts, as has been stated, to about 55 per cent. of the whole work; but even this includes the operation of reading the copy, which cannot be accelerated by machinery: so that the actual fingering of the keys is reduced to about 50 per cent. of the gross work. Supposing, therefore, that the compositor is enabled by the keys to set up seven letters for one that he could set up by hand, there results only a saving of about 43 per cent. on the whole process.

Another difficulty arises from the extremely irregular and fluctuating supply of work of any given character in printing establishments.

Unlike other extensive trades, there is in this but little classification. Every printing office undertakes every description of work, from a card to a book. But composing machines are not suited for doing cards, nor for what is called "displayed work," nor, in fact, for anything but tolerably plain straightforward work; so that frequent variations in the character of the supply are for machines very inconvenient. If these machines could, like the power loom, be kept regularly supplied with suitable work, their success would be assured, notwithstanding all drawbacks. A printer possessing sufficient capital, making mechanical composition the basis of his operations, and accepting only such other work as might be a necessary accompaniment of that, would undoubtedly, in the first instance, encounter difficulty in drawing business out of its accustomed channels, but would in the end be enabled to underbid competitors adhering to the old method. So long, however, as the present system prevails of doing all descriptions of work in one establishment, hand labour, from its versatility, certainly possesses an advantage as compared with any machinery.

As to what has been effected hitherto in actual work, it is sufficient to say that a pair of these machines, introduced into an establishment in New York about nine years ago, are still in use, together with several others afterwards purchased. Five years after their introduction, the proprietor of that establishment made the following comparative statement regarding one work,—a Bible, set in English size type—which he had just completed. The 1086 pages of the work were composed on two composing machines, and the distribution was done on two distributing machines. The entire work measured  $6\frac{1}{2}$  millions of letters, and was set up in sixty days with 1000 lbs. of type by three apprentices and one journeyman, and the distribution was done by two boys. The cost was as follows:—

|                                                                   |        |                 |
|-------------------------------------------------------------------|--------|-----------------|
| 769 pages set up by three apprentices, at two-thirds price, about | ...    | £. 38           |
| 317 " " " one journeyman                                          | ... .. | 24              |
| Two boys for distribution, and one for other purposes...          | ... .. | 13              |
|                                                                   |        | <hr/> Total £75 |

The same work done by hand composition, but without regard to time, would cost:—

|                                                                   |        |                  |
|-------------------------------------------------------------------|--------|------------------|
| 769 pages set up by three apprentices, at two-thirds price, about | ...    | £. 86            |
| 317 " " " one journeyman                                          | ... .. | 53               |
|                                                                   |        | <hr/> Total £139 |

The cost of the machine work was thus only 54 per cent. of hand setting: but to do the same work by hand composition in the same time of only sixty days would require at least ten journeymen and 2000 lbs. of type.

About two years ago a pair of these machines was placed on trial in the printing office of Messrs. Spottiswoode and Co., London, and the result of a month's performance was 500 hours of small pica reprint produced in 196 working hours. On this occasion the work was done by a compositor from the New York office. Three machines were thereupon adopted by this firm, and several others by printers in

London, Bungay, Glasgow, and Oxford. Although it cannot be pretended that in any of these establishments a result so favourable as the above has as yet been attained, still careful calculations show a margin of profit, small, indeed, at present, but increasing, and reasonably expected to go on increasing as the operators acquire skill, and difficulties and opposition of many kinds are smoothed away. Moreover, a collateral advantage appears in a diminution in the wear and tear of the type, and a diminution in the quantity of type required to produce a given amount of work.

The whole advantage of the machines may therefore be summed up as follows. First, a saving of about 43 per cent. in the labour of composition, under favourable, though not exceptional, circumstances. Secondly, a diminution of about 20 per cent. in the wear of type. Thirdly, a diminution of about 30 per cent. in the quantity of type required for a given amount of work.

In conclusion, it deserves to be mentioned, that although their progress has been very slow, in no case have these machines, when once introduced, afterwards fallen into disuse. It seems probable that ground so slowly won will not be lost; and that a portion, at least, of the great work of composition will hereafter be accomplished with the aid of machinery.

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## LONDON ASSOCIATION OF FOREMEN ENGINEERS.

October 3, 1863.

MR. JOSEPH NEWTON, ROYAL MINT, PRESIDENT, IN THE CHAIR.

Communication from M. ACHARD, "*On boiler explosions*," and paper by Mr. T. MILLER, "*On coating telegraph wires*."

THE proceedings commenced by the chairman reading a communication from M. Achard, C.E., in reference to sundry queries which had been put, but not answered, when, a month before, Mr. Gettliffe communicated his paper on "boiler explosions and railway accidents." It will be remembered that M. Achard's apparatus, then described, was intended for the maintenance of a constantly level feed in steam boilers; and the first of the queries ran as follows:—"If the float, refusing to act, causes the index to remain at zero, while the water falls in the boiler, how can the alarum bell, in consequence of the non-interruption of the electric current, be made to give the required signal?" The answer to this objection was, that in M. Achard's arrangement a stone float was immersed in the water with a counterpoise on an exterior shaft. The articulation consisted in the friction of a steel roller on a plane of polished cast iron, instead of the old stuffing-box system, which was, in many respects, imperfect, and liable to derangement. The resistance of the rolling friction was insignificant as compared with the gravitation of the stone float, and with that of the exterior counterpoise weight. The float known as "Bourdon's" also neutralized the objection raised; for it was scarcely possible for it to refuse to work freely, and it indicated alterations in the water level to the minute difference of 1-24th of an inch."

In reply to the second question raised—"Would it not be possible to cause the conducting wire to pass through the boiler, and communicate directly with the float?" M. Achard stated that the plan would be quite practicable. He had carried it out with success at Lyons, in the manufactory of Messrs. Coignet. In that case, the conducting wire was subjected to continual friction, which prevented oxidation, and the current circulated quite as freely as with Bourdon's float. The disadvantage of the arrangement, however, was, that it precluded the application of an indicator on the face of the boiler, which was imperative in France. The Bourdon float, therefore, superseded it, and it met every requirement.

The third of the series of queries was—"Which would be the best and most economical means of keeping the automatic regulator in operation during the temporary stoppage of the machinery and the absence of the workmen?" It was replied that, in order to secure this desideratum, which had not escaped the early consideration of the inventor of the regulator, he had at first added to it a direct electrical bell, which rang the alarm by means of the circulation of the electrical current; so that when the current no longer circulated for the regulator, it circulated for the direct electrical alarm—this latter operating notwithstanding the suspended action of the machinery. Of course the alarm in such case might be fixed in any convenient place—the office of the manager of the factory, for example. It had been found that this was but an extra precaution, which it was not absolutely essential to take; for the water in the boiler never descended, during such temporary suspension, more than an eighth or a quarter of an inch. A little reflection, indeed, would show, that when an engine was stopped *pro tem.*, the index of the regulator pointing to zero could not, owing to the non-consumption of steam, decrease more in height than had been stated.

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Mr. T. MILLER commenced his paper, "*On an entirely new mode of coating telegraph wires,*" by stating that he had devoted a considerable amount of time and attention to the subject he intended to try to elucidate, but as this was his maiden attempt at paper reading, he should claim the usual indulgence allowed in such cases—a considerable share of forbearance. If he failed in conveying, by pen and ink, an exact idea of his supposed improvements, he trusted that the diagrams he had prepared, and which he now placed before his fellow members, would successfully aid him in the performance of his task. (Those "diagrams," we may state, were elaborate and colored drawings, and they did assist the reader's explanations materially.) Mr. Miller went on to say, that his invention consisted, in the first place, in the preparation of India-rubber and similar gums in such manner that, after being cut, the lines or corrugations made by the cutting knife run in a longitudinal direction, instead of transversely, or across the strips, as at present practised. This was effected by means of a cutting machine, having its knives set in a longitudinal direction with the blocks of material from which it was proposed to cut the sheets. The knife might be made to advance to the block when in the act of cutting, or *vice versa*. The reciprocating knife might be made either

the whole length of the block of rubber or any portion of its length. If of the whole length, the framing which supported the knife, with its driving apparatus, would have no traversing motion; but if the reciprocating knife were only a portion of the length of the block, the frame would have given to it as much of a traversing movement as would cause the knife to cut freely over both ends of the block. Several kinds of knives might be used, as, for example, circular or irregularly-formed oval ones. These could be made to cut vertically or horizontally. When vertical cuts were being made, the blocks would be fixed to the platform by atmospheric pressure, the air being first exhausted from under the blocks by means of an air pump. The resulting sheets would be afterwards wound on a mandril, and cut into strips by the aid of another knife, mounted in a self-acting slide rest, with a traversing or to-and-fro motion. Another method which might be employed for making the cuts or corrugations longitudinal was that of masticating the rubber, placing it in an annular space in a heated press, and then pressing it by a heated follower until a solid ring was produced. This ring, which should have a rectangular cross section, would then be mounted in a cylinder or pulley fixed on a shaft, and driven at a proper speed. If the strips were required to be only equal to the circumference of the ring, the knife, mounted in a slide-rest, would be made to advance and cut the strip or ribbon to the thickness wanted. A second knife, fixed in a slide on the same rest, and at right angles to the first, would be made to cut the strip of the proper width. The slides, with their corresponding knives, could be actuated by cams, screws, and levers, so timed and arranged as that they would not interfere with each other's action. As the ribbons were cut, the knives assumed such positions as to allow the resulting strips to be thrown back off the revolving block from which they were cut, by the agency of a guide. If strips were required of a greater length than the circumference of the ring of rubber, two hoops would have to be placed in the annular space of the press, in such a manner that the thickest parts of the hoops should be opposite to each other, but lying in reverse directions. When the rubber was moulded in the press with these hoops, external and internal indents would be formed in the rubber of the same depth as the strips to be cut. This would insure that the strips should be of equal width when cut spirally. The knives would be so placed at right angles as to cut the strips spirally. The stroke of the radial traverse of both knives would be equal to the depth of the ring of rubber to be cut—that is, from the outer circumference towards the centre or inner circumference, or *vice versa*. \* \* \* After the strips in this case were cut, they were laid out evenly on long trays, open or otherwise, and with rows of small rollers mounted horizontally and vertically in their bottoms. They were then to be taken to a water bath, heated to the necessary temperature, and thus cleansed from dust or extraneous matter. After being sufficiently purified by this process, one end of each strip is taken hold of and passed through a series of rollers, each succeeding pair of rollers being driven at a greater speed than the pair preceding it. Thus the ribbons would be stretched in the most gradual and safe way. After passing the last pair of rollers, the strips would be attached to a reel and wound thereon. The reel would receive a rotary motion just

sufficient to keep the necessary tension while in the course of winding, and a longitudinal, to keep the folds of the strips from overlapping each other. When fully wound up, the last ends were to be fastened to the reel, which should be made of tin-plate, sheet-iron, or zinc, and might be shipped or unshipped readily. The full reels would afterwards be removed to a drying chamber, fitted with a series of heating pipes at the bottom, and a fan at the top to carry off the moist vapour. The drying being sufficiently effected, the strips were re-wound upon bobbins, which were then ready for transference to the covering machines.

The wire-covering machinery consisted in the mounting of one, two, or more hollow spindles on end, over and concentric with each other, and made to revolve on hollow studs or bearings, each spindle carrying a disc arm or arms, with a bobbin and spindles in each. The bobbin spindles were hinged or jointed to the discs, so that they might be set by a screw to any required angle to correspond with that of the rubber strips when being lapped round the wires.

The strips are guided on to the wires by small rollers mounted on the discs. On each of the bobbin spindles one of the before-named reels is secured by springs, washers, and nuts. The wire to be covered is wound on a drum below the under end of the hollow spindles. This drum is kept steady in its motion by a friction brake. The end of the wire is passed upwards through the hollow stud or spindle, where, when it has passed a certain distance, it gets a covering of rubber from off a bobbin attached to the inner hollow spindle; and in succession one or more layers are laid on from the bobbin attached to the next hollow spindle, and so on from the next if that be required. The hollow spindles may, if that be found desirable, be driven at different speeds. The wire then passes between guide rollers, and also between a pair of small pulleys, centred on and carried by a pair of levers free to oscillate on their centres, and the use of which will presently be shown. The wire is then carried up over a leading pulley fixed on a shaft. The shaft and pulley receive motion by gearing from one of the hollow spindles through which the wire has been conducted. Round this last-named pulley the wire is passed once or oftener, to ensure its taking a proper hold. The end of the wire is then carried under another pulley placed at the bottom of a small but deep cistern containing water, and then again carried upward over guide-pulleys, whence it is wound on to a drum. The drum is driven by a frictional arrangement. The wheels and pulleys must be so proportioned as that the drum shall always have more surface motion than the leading pulley, so that the wire shall not lose its "bite," and be thus carried through the machine. The drum has a traversing motion parallel with its axis, in order to ensure that each round of the covered wire shall be laid on without overlapping. The traversing apparatus accommodates itself to any thickness of wire.

The machines are self-acting, and the insulation of the wire being of great moment, the appliance for stopping the machine, when a flaw occurs, shall be first described. An electric current is passed through an electro-magnet, and attracts an armature, which, by the intervention of levers, rods, and catches, causes the machine to be thrown out of gear, and an alarm bell to be sounded. The end of the covered wire

is in connection with a battery, and so long as there is no flaw in the insulation, no current passes through the covered wire. When, however, a flaw in the wire covering enters the water, it completes the circuit between the poles of the battery through the magnet coils by another wire, one end of which terminates in the water and the other at the opposite pole of the battery. When a strip is being laid on the wire, it is kept in a state of tension; and while revolving, it touches a lever, which is furnished with a catch at one end. This lever is centred on the arm of another, in connection with the stopping gear of the machine. So long, therefore, as the rubber is being paid off the bobbin on to the wire, the lever will be kept back and out of gear; but should the strip break, or run out, there is nothing to strike the lever back, and it is gently advanced by a spring: the catch on the opposite end of the lever then takes into a notch on a vibrating lever, and throws the apparatus out of gear.

The small pulleys before alluded to, and centred on levers, are connected with the striking or stopping gear in such a manner, that should the wire covering be unequally laid, the passage of the wire between them causes them to separate from or approach each other, and in either case, by the agency of levers, to act on the stopping gear, and to sound an alarm, for the purpose of calling attention to the inequality. All the sets of spindles are arranged round one central upright shaft, on which the main spur-wheel for working them is hung. On the same shaft is fixed an excentric, for working the striking apparatus by a connecting rod to each set of spindles. The upright shaft may be driven from a lying shaft and bevil gearing below the floor line. This compact arrangement of say six or more sets of spindles round one upright shaft is advantageous, as giving free access to each set, and reducing the amount of manual attendance. It is possible to place as many spindles round an upright shaft as is necessary to make up a cable at one time. In this case the covered wires would be led upwards angularly until they met in a guide piece, which they would pass through, and then be twisted into a cable by a twisting apparatus. The cable drum would have three motions—a horizontal one to twist the cable, a vertical one to wind the cable round itself, and a longitudinal traversing motion to lay the coil on helically and regularly. If a core were necessary for winding, the cable strands over the centre shaft and guide pins would require to be hollow. If desirable, the sets of spindles might be mounted in long parallel frames, similar to the mounting of spindles in spinning frames,—that is, with a row of spindles on each side the frames,—whereby ready access would be gained to each spindle, as in the circular system just referred to. The India-rubber coverings of the wires might be rendered homogeneous by exposure to heat, after the manner pursued with some other India-rubber manufactures. The exposure could be effected in single covered wires, or after two or more had been twisted into cable form.

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## Provisional Protections Granted.

[Cases in which a Full Specification has been deposited.]

2320. William Elsdon, of Sandridge, Victoria, the construction of rail and road carriages, and impd. wheel tires, and an impt. in railway crossings, adapting them to such carriages.—*September 21st.*
2397. Ezekiel Williams Bullard, of Massachusetts, U.S.A., machine or carriage for turning and spreading hay, and for other useful agricultural purposes.—*September 30th.*
2401. James Mackay, of Aigburth, Lancashire, impts. in fire-arms, ordnance, and projectiles.—*October 1st.*
2473. Louis Lefebvre, of Cecil-street, Strand, impts. in vapor bath apparatus.—*October 9th.*

[Cases in which a Provisional Specification has been deposited.]

1401. Arthur Quentin de Gromard, of Paris, impts. in musical instruments.—*June 5th.*
1449. William Clark, of Chancery-lane, impts. in obtaining and applying motive power, and in apparatus for the same,—a communication.—*June 11th.*
1605. Henry Clay Lee, of Lawrence Pountney-lane, impts. in the construction of sewing machines,—a communication.—*June 25th.*
1725. Thomas Legg, of Northampton-square, and Richard Griffith, of Exmouth-street, impts. in the construction of sewing machines.—*July 10th.*
1869. Roger Dawson, of Craven-street, impd. method of annihilating or extinguishing fires.—*July 28th.*
1887. Joseph Bennett Howell, of Sheffield, impts. in ordnance, fire-arms, and projectiles.—*July 30th.*
1924. Eugène Alphonse Cotellet, of Paris, method of manufacturing gas alcohol by means of diluted acids acting indefinitely without reconcentration.—*August 4th.*
1950. Frederick George Mulholland, of Essex-street, impts. in pipe castings for gas, water, sanitary, and other general purposes, and the introduction of an elastic chemical compound to form expansive joints thereto, for prevention of leakage.—*August 7th.*
1989. Louis Rudolph Bodmer, of Thavies-inn, impd. mode and apparatus for dressing and finishing, and for imparting lustre to yarn and thread made of silk, cotton, and other fibrous substances,—a communication.
1995. Robert Stirling Newall, of Gateshead, impts. in apparatus for serving ropes for ships' rigging, and other purposes.
- The above bear date August 12th.*
1998. Chales Colton Dennett, of Nottingham, impd. method of fire-proof construction for buildings, by the use of arches formed of concrete.—*August 13th.*
2030. John Grantham, of Nicholas-lane, impts. in apparatus for manufacturing salt.—*August 15th.*
2041. Robert Baillie, of Glasgow, impts. in reefing or furling the sails of vessels, and in the apparatus to be employed therein.—*August 17th.*
2056. Charles George Wilson, of Blackheath, impts. in machinery for pressing cotton, and for crushing and pressing other substances; the said machinery being adaptable for locomotion on railways or on common roads.—*August 18th.*
2091. Henry Batt, of Charlton, King's-road, Kentish-town, impts. in roughing horses without taking off the shoe.
2096. Frederick Rice Stack, of Belgrave-villa, Finchley, impts. in the construction of military bridges, piers, landing stages, and escalading apparatus.
- The above bear date August 24th.*
2103. James Thomas and William Fielding Marshall, of Shipley, Yorkshire, impts. in apparatus for spinning.—*August 26th.*
2119. Charles Richard, of Paris, ap-

paratus for lighting and cutting the ends of cigars.

2121. George Richards, of Caroline-street, Bedford-square, impts. in the construction of ordnance and fire-arms, and in the projectiles to be used therewith.

*The above bear date August 27th.*

2127. Louis Alexandre Mulet, of Paris, impd. method of shoeing horses, and covering the feet or hoofs of other domestic animals with hardened india-rubber, gutta-percha, and other impd. similar materials.—*August 28th.*

2137. William Whitworth and Joseph Wrigley, of Sowerby-bridge, near Halifax, impts. in or applicable to the furnaces of steam boilers.—*August 29th.*

2145. George Attock, of Stratford, Essex, impts. in assistant bearing springs for locomotive engines, railway carriages, waggons, and trucks.

2148. George Bebbington and Jonathan Robert Hampson, of Manchester, impts. in means to be employed for securing the ends of bands in packing "bale goods," and in machinery for manufacturing "rivets" to be employed for the purpose, and also in apparatus for forming apertures in the aforesaid bands or hoops.

2152. Alfred Vincent Newton, of Chancery-lane, impd. machinery for sawing irregular forms of wood,—a communication.

*The above bear date August 31st.*

2160. Pierre Joyot, jeune, of Paris, impd. fabric, and impts. in looms for manufacturing the same.

2161. John Henry Banks, of Manchester, impts. in the construction of benches or desks for schools, churches, and other similar purposes.

*The above bear date September 1st.*

2167. Robert Young, of Glasgow, impts. in separating and elevating apparatus for grain or granular matters.

2168. Elizabeth Collier, of Leicester, impts. in crinolines and crinoline fastenings.

2169. Reuben Sims, of Leigh, Lan-

cahire, impts. in reaping and mowing machines.

2171. Emile Alcan, of King-street, City, method of, and apparatus for, feeding wool and other textile and filamentous substances into carding, combing, and other machines for treating such substances,—a communication.

2172. Frederick Charles Philip Hoffmann, of Newgate-street, impts. in machines for crushing hard substances, for washing ores and minerals, and for separating earth and earthy matter from solid substances.

*The above bear date September 2nd.*

2173. Charles Jackson, of Birmingham, impts. in bolts for fastening doors, windows, shutters, and for other like purposes.

2174. Amand Louis Durand, of Paris, impts. in the manufacture of nails and other similar articles.

2175. André Alexandre Beaumont, of Paris, impd. engine for raising liquids.

2176. William Boulton and Joseph Worthington, of Burslem, impd. method of making and inlaying encaustic tiles or other plastic articles and substances.

2178. William Jolliffe, Thomas Jolliffe, William Graham, and Henry Taylor, of Liverpool, impts. applicable to paddle and other propelling wheels for navigable vessels.

2181. Alfred Vincent Newton, of Chancery-lane, impd. apparatus for cleaning and decorticating grain and seeds,—a communication.

2182. Joseph Loeb and Ignaz Pick, of Bush-lane, impts. in fastening gloves.

*The above bear date September 3rd.*

2183. Charles Thornhill, of Sheffield, impd. method of adapting steel or other suitable metallic wire, to be used instead of animal bristles or hair in sewing boots, shoes, saddlery, and leather works generally.

2184. Charles Grant Kelvey and William Holland, of Rock-ferry, Cheshire, impts. in the construction of chronometers and other time-keepers.

2185. John Hendry and William

Coutts, of Aberdeen, impts. in furnaces.

2186. Thomas Fisher, of Remington-street, City-road, impts. in spring balances where spiral springs are used.

*The above bear date September 4th.*

2187. William Lorberg, of Wyld's Rents, Bermondsey, impts. in the manufacture of gas and other substances from tan and similar materials.

2188. George Hargreaves, of Bradford, Yorkshire, impts. in steam boilers.

2189. Samuel Millbourn, of Carshalton, impts. in the preparation of materials for the manufacture of paper, and in the construction of machinery employed for such purposes.

2190. William Norton, of Holly Bank, near Arva, Cavan county, impts. in laying and supporting submarine telegraph cables.

2191. Thomas Moody, of Wincanton, Somersetshire, and Edward Toms Moody, of Chelsea Villas, West Brompton, impts. in the generation and production of motive power, to be applied generally, and in its special application to the propulsion of vessels.

2192. Joseph Rowell, of Aberdeen, impts. in the manufacture and construction of fences; part of which are also applicable to the manufacture and construction of gate posts, and to poles and posts used for telegraph and signal purposes, and for stretching telegraph wires.

2193. Thomas Smith, of Wolverhampton, impd. waggon break.

2194. Richard Batt, of Milnthorpe, Westmoreland, impts. in paper-making machinery.

2195. Charles Henry Adames, of Birmingham, impts. in the manufacture of lids or covers for certain articles of holloware.

2196. George Banks Rennie, of Holland-street, Blackfriars, impts. in the construction of floating docks and pontoons, and the means of cleaning, painting, or repairing them.

*The above bear date September 5th.*

2197. Frederick Mills, Thomas Booth,

and Thomas Clegg, of Heywood, Lancashire, impts. in machinery for preparing and spinning cotton and other fibrous substances.

2198. Josias Bull York, of Coleshill, Warwickshire, impts. in privies or closets, to be used in place of water-closets.

2199. Nathan Sington, of Manchester, impts. in machinery or apparatus for cutting hay, straw, or other similar agricultural produce,—a communication.

2200. Harper Twelvetees, of Bromley, impts. in portable mangling and wringing apparatus.

2201. Alfred Vincent Newton, of Chancery-lane, impd. apparatus for directing motion in right lines,—a communication.

2202. Samuel Gerish, of Shoe-lane, and John Weston, of Whitecross-street, impts. in machinery for morticing, drilling, dovetailing, and cutting wood, and in tools to be used for morticing.

*The above bear date September 7th.*

2203. Ludwig Mond, of Appleton-in-Widness, impts. in obtaining sulphur and sulphurous acid from alkali waste.

2204. Joseph Horatio Cutler, of Birmingham, impd. dress fastening; which said fastening is also applicable to the fastening of bands and belts, and to other like purposes.

2205. John Crowgey Lott, of Clyro, Radnorshire, impd. apparatus for turning over the leaves of music.

2206. William Ashley Wilson and James Smith, of Liverpool, impts. in furnace fire-grates.

2208. Thomas Henry Baker and George Friend, of Tunbridge, Kent, impts. in treating excrementitious and sewage matters, and in the means or apparatus employed therein.

2209. Richard Archibald Brooman, of Fleet-street, impts. in machines for working and preparing skins,—a communication.

2210. William Hewitt, of Bristol, impd. rudder, and means of working the same.

2211. James Deas Jack, of Montrose, impts. in moulding or shaping metals.

*The above bear date September 8th.*

2213. Walter Henry Tucker, of Southampton-street, Strand, impts. in the modes of propelling and steering vessels.
2214. Joseph Lille and John Haines White, of Manchester, impd. composition or coating for the protection and preservation of surfaces of iron, wood, and other materials.
2215. William Higgs Hawksworth, of Oldham, impts. in apparatus for preparing cotton and other fibrous materials for spinning.
2216. Thomas Naden the younger, of Birmingham, impts. in raising the covers or lids of hot-water jugs, tea pots, coffee pots, and other vessels.
2217. William Glydon, the younger, of Birmingham, impts. in apparatus and machinery for the manufacture of metallic tubes and hollow cylinders; part of which impts. may also be applied to the casting of other hollow bodies.
2219. William Edward Gedge, of Wellington-street, impts. in paving roads or ways,—a communication.
2220. Edward Thomas Hughes, of Chancery-lane, impts. in the manufacture of chenille, and in the machinery or apparatus employed therein,—a communication.
2221. John Robinson, of Batley, Yorkshire, impts. in steam boiler and other furnaces.
2222. William Clark, of Chancery-lane, impts. in the means of utilizing refuse azoted matters of commerce, for the manufacture of various chemical products,—a communication.
2223. Nathan Thompson, of Abbey-gardens, St. John's Wood, impts. in apparatus for stopping bottles, jars, and other vessels; which impts. are also applicable to stopping the muzzles of fire-arms.
2224. George Tomlinson Bousfield, of Loughborough-park, Brixton, impts. in rollers to be used in machinery for spinning and manufacturing wool, cotton, and other fibrous materials,—a communication.
2225. William Hutchinson, of Salford, impts. in steam engines.
2226. Alfred Vincent Newton, of Chancery-lane, impt. in steam engines,—a communication.
2227. Jacob Maggs, of Bath, impd. construction of fountain pen.
2228. Edward Oliver and George Myers, of Rotherham, impts. in apparatus for lowering and disengaging boats from vessels.
- The above bear date September 9th.*
2229. John Hays Wilson, of Liverpool, impts. in side-lights for ships and other navigable vessels, and in the manufacture of the same.
2231. William Wellington Greener, of Birmingham, impts. in breech-loading fire-arms.
2232. Holmes Wright and John William Wright, of Morton, near Bingley, and William Clough, of Keighley, impts. in glazing and rolling press-papers, paste-board, and other paper requiring to be glazed or rolled, and in the means or apparatus employed therein.
2233. Matthew Andrew Muir and James McIlwham, of Glasgow, impts. in machinery or apparatus for winding yarns or thread.
2234. William Clark, of Chancery-lane, impts. in the purification and disinfection of hydro-carburets, and especially of oils produced by the distillation of coal, schist, and bog-head,—a communication.
2235. James Heywood Whitehead, of the Royal George Mills, near Manchester, impts. in the manufacture of felted fabrics.
- The above bear date September 10th.*
2236. James Hartshorn and William Redgate, of Nottingham, impts. in the manufacture of lace, and in means or apparatus employed therein.
2237. William Taylor, of Shiffnal, Salop, impts. in the manufacture of iron rods, and in machinery to be employed in the said manufacture.
2238. Louis Desens, of Paris, impd. bath or bathing machine adapted for deep water.
2239. Thomas James Sloan, of Paris, impts. in braiding machines.
2240. Joseph Rhodes, of Morley, near Leeds, impt. in piecing machines.
2242. James Dobbie, of Saint Petersburg, impts. in the construction of railway and other carriages.
2243. James Denby Lee and James

Crabtree, of Shipley, near Bradford, impts. in looms for weaving.

2244. Henry Crichley, of Birmingham, impts. in stove grates and kitchen ranges.

2245. Moritz Gerstenhöfer, of Freiberg, Saxony, impd. construction of furnace for roasting pyrites.

*The above bear date September 11th.*

2246. James Crellin, of Liverpool, impts. in apparatus for governing and stopping the flow or passage of fluids.

2247. James King, of Glasgow, impd. means for assisting and regulating the process of fermentation.

2248. Charles Edwin Wallis, of Millman-street, Bedford-row, impts. in revolving fire-arms.

2249. Ebenezer Noah Gregory, of Camberwell, impd. method of uniting belts and lengths of wire gauze and other metal cloth.

2250. William Clark, of Chancery-lane, impts. in revolving fire-arms, —a communication.

2251. Douglas Symonds Sutherland, of Great George-street, Westminster, impts. in blasting rocks and other materials.

2252. John Adams Whipple, of Boston, U.S.A., impts. in apparatus for supporting photograph cameras.

*The above bear date September 12th.*

2253. Henry Riviere, of Queen's-road, Bayswater, impts. in the construction and application of apparatus and implements used for the purposes of heating, cooling, and evaporating.

2254. William Ross Hutton, of Glasgow, impd. lubricating compound.

2255. Thomas Bell, of Wishaw, Lanarkshire, impts. in apparatus for distilling shale or other bituminous minerals.

2256. William Edward Gedge, of Wellington-street, Strand, impts. in safety lamps for mines,—a communication.

2257. George Francis Millin, of Oxford, impd. arrangements for facilitating the quick detachment of horses or draught animals from carriages or vehicles, and for the application of break power, with the view to prevent accidents.

2258. George Whitfield Billings, of New York, impd. method of preparing the fibres of hemp, flax, and other vegetable materials for manufacturing purposes.

2259. William Gossage, of Widnes, impts. in drying or curing certain vegetable productions.

*The above bear date September 14th.*

2260. Charles Battcock, of Wandsworth, impts. in cigar lighters and fusee matches; parts of said impts. being applicable also to vestas and matches, wax tapers, and candles.

2261. George Howell, of Old Kent-road, impts. in machinery for stamping or obliterating and printing, especially applicable to post-office purposes; parts of which impts. are applicable to machines in which cams are employed.

2262. Warren Thompson, of Paris, impts. in electric telegraph apparatus.

2263. Andrew Barclay, of Kilmarnock, impts. in locomotive or other steam engines.

*The above bear date September 15th.*

2264. Joseph Fox, of Derby, impts. in machinery for planing or cutting off the sides of armour plates.

2265. Andrew Fleming, of Glasgow, impts. in cutting or finishing matting and similar fabrics, and in the machinery used therefor.

2266. Gabriel Lewal, of Philpot-lane, impd. method of, and apparatus for, consuming smoke, and heating and warming public and other buildings, and for drying purposes generally.

2267. John Cox, of Gorgie Mills, Edinburgh, impts. in swings.

2268. James Rahill, of the Minories, impts. in liquid compasses.

2269. Alfred Watson, of King-street, impt. in hinges.

2270. James Dannatt, of Sunderland, impts. in the construction of apparatus for cooling liquids.

2271. Benjamin Latchford, of Upper Saint Martin's-lane, impd. spur.

2272. Bernard James Webbe, of Newton Abbot, impts. in threshing machines.

2273. Robert Thomson, of Manchester, impd. mixed fabric, and in the ap-

- plication thereof to covering umbrellas and parasols.
2274. Edward Scott, of Manchester, and John Starkey, of Salford, impts. in looms for weaving.
2275. Robert Harrington, of Birmingham, impts. in umbrellas and parasols, and in parts thereof.
2276. John Maclean Tate, of Bermondsey Wall, impd. method of hanging the lower top-sail yards of ships and other sailing vessels.
- The above bear date September 16th.*
2277. James M'Ewen, of Lay's Foundry, near Brierly-hill, Staffordshire, impd. combined coke oven, and hot-blast oven or apparatus.
2278. Zacharie Joseph Mercier, of Paris, impd. gas cock of elastic and continuous pressure.
2279. William Edward Gedge, of Wellington-street, Strand, impd. instruments for ascertaining levels, also for computing angles,—a communication.
2281. Alexander Chaplin, of Cheyne-walk, Chelsea, impts. in apparatus for propelling ships or vessels.
2282. Phineas Cowan, of Barnes, Surrey, impt. in refining sugar.
2283. Fédor de Wyldé, of Trinity-square, Tower-hill, impts. in the manufacture of an hydrated silica.
2284. Richard Archibald Brooman, of Fleet-street, impts. in taps,—a communication.
2285. John Gottlieb Ulrich, of Well-close-square, impts. in apparatus applied to railway carriages and trains. in order to obtain greater safety to passengers.
2286. John Henry Johnson, of Lincoln s-inn-fields, impts. in life belts and swimming belts,—a communication.
2287. Peter McLaurin, of Glasgow, impts. in drying paper, pasteboard, and similar fabrics, and in the machinery, apparatus, or means employed therein.
2289. James Whitehead, of Calverley, near Leeds, impts. in pneumatic motive power machinery.
- The above bear date September 17th.*
2290. James Allen, of Manchester, impts. in the construction of valves and cocks for steam, water, gas, and other fluids.
2291. John Roberts and Robert Naylor, of Manchester, impts. in increasing, diminishing, or otherwise regulating, the power and tone of organs, harmoniums, pianofortes, or other instruments with similar keys or key boards.
2292. Robert Doyne Dwyer, of Warrington, impd. apparatus for cleaning and painting or coating the bottoms of ships and other structures.
2293. George Davies, of Serle-street, impts. in the manufacture of iron and steel, and in apparatus to be employed in such manufacture,—a communication.
2294. William Lorberg, of Wyld's-rents, Bermondsey, impts. in the treatment of rags, and obtaining valuable chemical products from the animal fibre therein.
2295. Isham Baggs, of Cambridge-terrace, impts. in the means of protecting and preserving the hulls and bottoms of ships and vessels from fouling and corrosion.
2296. Alfred Noirot, of Paris, new tiles.
2297. John Mason Cook, of Leicester, impts. in railway carriages and all other sprung vehicles.
2298. Richard Archibald Brooman, of Fleet-street, impd. thread for fishing nets,—a communication.
2299. Herbert William Hart, of Fleet-street, impt. in T fastenings.
2301. Alfred Vincent Newton, of Chancery-lane, impt. in propelling vessels, and in apparatus relating thereto,—a communication.
2302. William Smith, of Salisbury-street, impts. in constructing breech-loading ordnance,—a communication.
2303. William Smith, of Salisbury-street, impts. in the construction and mode of working ordnance for ships and forts, and in the means of protecting those engaged in working guns employed for such purposes,—a communication.
2304. Thomas Small, of Bargate, Lincolnshire, impts. in motive power machinery.
2305. Vancencellos Houghton, of West

Reading, impts. in lamps and lamp wicks,—a communication.

*The above bear date September 18th.*

2306. Louis François Chezaud and Henry Jeremie Christen, of Paris, impts. in printing postage stamps, bankers' bills, shares, and other similar documents, and in machinery employed therein.

2307. John Buckley, of Lees, Yorkshire, impts. in "mules" for spinning cotton and other fibrous substances.

2309. Richard Couchman, of Noble-street, impts. in articles or instruments for supporting, holding, or carrying parasols, bags, watches, ornaments, or other articles or appendages.

2310. Charles Louis Fleischmann, of Paris, impts. in machinery or apparatus for ginning cotton, also for cleaning, opening, and preparing cotton, wool, or other fibrous substances.

2311. Benjamin Davis, of Brettle-lane, and William Bowler, of Wall-beath, Staffordshire, impd. mode of strengthening tilt hammers.

2312. John Carpenter Pooley, of Bath, impts. in brewing or preparing beverages from malt and hops.

2313. John Paul Baugh Le Patourel, of Guernsey, impts. in breech-loading fire-arms.

2314. Ignazio de Angelis, of Naples, impd. apparatus for obtaining motive power,—a communication.

2315. Thomas Richardson, of Newcastle-on-Tyne, John James Lundy, of Leith, and Robert Irvine, of Midlothian, impts. in the extraction or manufacture of oils from vegetable substances.

2316. Hyde Bateman, of Barnes, Surrey, impd. construction of rotary engine.

2317. Thomas Edward Vickers, of Sheffield, impd. in the manufacture of cast steel tyres,—a communication.

*The above bear date September 19th.*

2319. Edmond François Rattier, of Paris, impts. in crinolines.

2321. William Burnet Robins, of Har-

borne, Staffordshire, impts. in portable fire and garden engines.

2322. Anne Abbey Downes, of Stonnall, Staffordshire, impts. in artificial teeth.

2323. Emile Alcan, of King-street, impts. in shears for cutting metal threads, wires, and rods; applicable also for gauging wires,—a communication.

2324. Emile Alcan, of King-street, City, impts. in condensers applicable to wool carding engines,—a communication.

2325. François Alfred Châtel, of Paris, impts. in burners for burning all mineral oils,—partly a communication.

2326. Richard Wallis, of Basingstoke, impts. in loading and unloading vessels, and raising, lowering, and otherwise conveying, sacks, casks, agricultural produce, and other objects, from one locality to another.

2327. Robert Ridley, of Leeds, and James Grafton Jones, of Cumming-street, Pentonville, impts. in apparatus for giving a reciprocating motion to picks and cutting tools used in getting coal and other minerals and stone.

2328. George Tomlinson Bousfield, of Loughborough-park, Brixton, impts. in power looms for weaving hair-cloth and fabrics, on which the web is inserted in separate lengths of material,—a communication.

2329. Charles Thomas Burgess, of Upper Gower-street, impts. in reaping machines.

2330. Hiram Hutchinson, of Paris, impts. in machinery for manufacturing moulded articles of india-rubber,—a communication.

2331. Thomas Barnabas Daft, of Harlesden, impts. in the construction of ships and vessels, and in sheathing the same.

2332. Wilhelm Adolf von Kanig, of Bedford-place, Russell-square, impts. in railway telegraphs and signals, and also in the permanent way and carriages, for preventing railway accidents.

*The above bear date September 21st.*

2333. Joseph Renshaw and John Ha-

- worth, of Manchester, impts. in machinery for stretching woven fabrics.
2334. Gustave Maillard de Bayelt, of Stamford-street, and Joseph Emile Vigouléte, of Pitt-street, Fitzroy-square, impd. method of compounding, by agglomeration, artificial fuel.
2335. Peter Effertz, of Manchester, impts. in machinery or apparatus for making bricks, tiles, pipes, and other similar articles.
2336. Charles Maitland, of Alloa, Clackmannan, N.B., impts. in mashing apparatus.
2337. John Bond and James Bond, of Longridge, near Preston, impts. in brick and tile making machinery; applicable also to machinery for manufacturing other articles from plastic materials.
2338. Richard Archibald Brooman, of Fleet-street, certain compositions for preserving cheese,—a communication.
2339. John Brigham and Richard Bickerton, of Berwick-on-Tweed, impts. in reaping or mowing machines.

*The above bear date September 22nd.*

2340. William Cleminson, of Ashton-under-Lyne, impts. in the construction of pipe wrenches.
2341. James Platt, of Argyle-street, St. Pancras, impts. in machinery applicable to steam and water engines (as motors); which machinery is also applicable to lift and force pumps.
2343. William Galloway and John Galloway, of Manchester, impts. in lubricating journals of revolving shafts and axles, and in the apparatus employed for that purpose.
2344. Edward Thomas Hughes, of Chancery-lane, impts. in gas condensers,—a communication.
2345. Walter Gibb and James Holland, of Eccles, Lancashire, impts. in looms for weaving.
2346. William Thomas Eley, of Gray's-inn-road, impts. in the manufacture or construction of ball cartridges.
2347. Augustus Collingridge, of Cheap-side, impts. in the manufacture of casks and other receptacles for containing oil, petroleum, and other liquids.

2348. John Phillips, of Tollington-road, Holloway, impts. in the construction of levels, applicable to levelling, surveying, astronomical, nautical, and other instruments or purposes to which levels are applicable.

*The above bear date September 23rd.*

2350. Adolphe Ernest Ragon, of Caroline-street, Bedford-square, impd. machinery or apparatus for stirring or mixing various ingredients or materials to a pasty consistence; said machinery being especially adapted to the manufacture of bread and other articles of food,—a communication.
2351. William Woofe, of Gloucester, impts. in implements for tilling the soil, and in means of drawing ploughs and other implements for tilling through the land.
2352. Thomas Marshall, of Gate-street, Lincoln's-inn-fields, and William Marshall, of Regent-street, metallic instruments to be used as substitutes for bristles in sewing, stitching, closing and otherwise joining boots, shoes, and other leather work.
2353. Ernest Dronke, of Liverpool, impd. mode of manufacturing gunpowder, suitable for war, mining, and general purposes,—a communication.
2354. William George Helsby, of Liverpool, impts. in mounting or setting transparent photographic pictures.
2355. Amos Firth, of Bradford, impts. in furnaces for heating wheel hoops; applicable also for other similar purposes.
2356. James Webster, of Birmingham, impts. in utilizing the waste flux from galvanizing works.
2357. John Sturgeon, of Leeds, impts. in machinery for cutting and boring coal and rocks.
2358. William Oxley, of Manchester, impts. in pickers for looms.
- The above bear date September 24th.*
2363. Alfred Vincent Newton, of Chancery-lane, impd. joint for the tubes of surface condensers,—a communication.
2364. Peter Spence, of Manchester,



impts. in the production of sulpho-cyanide of ammonium, and other sulpho-cyanides.

2365. Edward Lloyd, of Dee Valley, Merionethshire, impts. in rotary engines, to be worked by water, steam, air, and other motive power.  
2366. Mathias Schaffhauser, of Cernay, France, impts. in the machinery for making paper tubes used in spinning manufactories.

*The above bear date September 25th.*

2367. George Spill, Thomas James Briggs, and Daniel Spill, all of Hackney Wick, impts. in the manufacture of driving straps or bands, and of flexible tubes or hose.

2368. William Tertius Rowlett, of Leicester, impts. in crinolines and hooped skirts.

2369. Richard Clarke, of Altringham, application of material for covering crinoline, and in the manufacture of the said material.

2370. William Clark, of Chancery-lane, impd. fabric for the production of permanent electricity, applicable for wearing apparel,—a communication.

2371. James Spence, of Portsmouth, impd. plastic composition, applicable to the coating of metallic and other surfaces.

2372. Abraham Gleeurup, of Copenhagen, impd. construction of gas-burner,—a communication.

2374. William Malam, of Deptford, and William Tice, of Downham-road, impts. in apparatus for supplying gas to railway carriages and other moving structures, and in apparatus for manufacturing and holding gas in ships and other vessels; parts of such apparatus being also applicable for manufacturing and holding gas elsewhere.

*The above bear date September 26th.*

2377. Louis Joseph Joachin Jean, of Paris, impts. in the construction of steam boilers, and in their fire-grates.

2378. Pierre Bouchani, of Paris, impd. wax-light or candle stand.

2379. Peter Cato, of Liverpool, impts. in the construction of combined iron and timber ships.

2380. John Tertius Harlow, of Upper Saltley, near Birmingham, and Edmund Harlow, of Balsall-heath, impts. in breech-loading fire-arms.

2381. William Edward Gedge, of Wellington-street, impd. apparatus for heating by means of illuminating gas,—a communication.

2382. John Henry Johnson, of Lincoln's-inn-fields, impts. in the manufacture of boot and shoe toe-pieces or tips, and in the machinery or apparatus employed therein,—a communication.

2384. Griffith Thomas, of Chichester-villas, Kilburn-park, impts. in Louvre shutters and Venetian blinds.

*The above bear date September 28th.*

2385. Francis Preston, of Manchester, impts. in machinery for rolling and cutting files and rasps.

2386. Frederick George Mulholland, of Essex-street, impts. in the mode of manufacturing submarine telegraph cables, in apparatus connected therewith, and in the method or principle of laying the same; and in the preparation of the several compounds described for electric insulation, and other purposes.

2387. Sam Mendel, of Manchester, impts. in the manufacture of woven fabrics, applicable to covering telegraph wires.

2388. Henry Haigh and Richard Heaton, of Milns-bridge, near Huddersfield, impts. in dyeing cotton or other vegetable fibrous substances.

2389. William Clark, of Chancery-lane, impd. in the soles of boots and shoes,—a communication.

2390. William Edward Gedge, of Wellington-street, impts. in parts of the permanent way of railways,—a communication.

2391. John Cooper, of Ipswich, impts. in the construction of harrows.

2392. Peter Llewellyn, John Llewellyn, and John Wanklyn James, all of Bristol, impts. in water-closets.

*The above bear date September 29th.*

2393. John James Chidley, of Glaskin-street, Hackney, impd. bottle and stopper.

2394. William Clark, of Chancery-

lane, impts. in musical instruments,  
—a communication.

2395. Henry Edward Skinner, of Shad-  
well, conical packing for taps.

2398. George Elliott, of Betley Hall,  
Staffordshire, impts. in props and  
supports for coal and other mines.

2399. Benjamin Browne, of King Wil-  
liam-street, impd. sight piece for  
rifles,—a communication.

*The above bear date September 30th.*

2405. Francis Reid, of Liverpool, col-  
lecting and saving the spirit or  
alcohol generated by spontaneous  
fermentation in raw sugar, concrete,  
melado, and molasses, and thrown  
off during the process of boiling or  
refining.

2407. William Edward Newton, of  
Chancery-lane, impd. apparatus for

cleaning rice and other grain,—a  
communication.

2409. Percy Leslie, of Eastbourne,  
Sussex, impts. in preserving the  
bottoms of ships or vessels and other  
surfaces from the prejudicial effects  
of marine animals and vegetables.

*The above bear date October 1st.*

2413. Johann Ernst Friedrich Lüdeke,  
of Stonefield-street, Islington, and  
Maurice Fischer, of Paris, impts. in  
obtaining motive power.

2415. James Tees, of Glasgow, impts.  
in packing for stuffing boxes and  
pistons.

2417. William Edward Gedge, of Wel-  
lington-street, impd. pen holder and  
feeder,—a communication.

*The above bear date October 2nd.*

## New Patents Sealed.

1863.

326. H. Dircks and J. H. Pepper.  
803. R. A. Brooman.  
813. William Symons.  
815. J. Dale and G. Bischof.  
819. Hesketh Hughes.  
820. James Carver.  
824. E. T. Hughes.  
825. John Smethurst.  
826. A. B. D. Maurand.  
830. R. A. Brooman.  
835. J. Hindle, W. F. Calvert, and  
E. Thornton.  
836. Isaac Rowland.  
837. Joseph Bray.  
840. Walter West.  
841. William Mitchell.  
845. W. H. Phillips.  
846. J. W. Law and J. Inglis.  
847. E. F. Clarke.  
849. John Cassell.  
850. J. J. Pötel.  
853. A. P. Price.  
854. A. B. Leithen.  
856. James Blain.  
857. Prosper Hanrez.  
864. F. C. Bakewell.  
865. Benjamin Cooper.  
870. John Burwin.  
872. J. Swinburne and J. Stanley.  
874. A. C. Bamlett.  
878. R. A. Brooman.  
879. R. A. Brooman.  
889. W. H. Mitchel.

890. J. L. Norton.  
891. Arthur Kinder.  
896. George Spencer.  
897. A. Hett and F. W. Basset.  
907. Thomas Baldwin.  
908. S. Shelmerdine and J. Dransfield.  
910. Robert Smith.  
916. John Lockwood.  
917. Daniel Mylrea.  
920. William Clark.  
921. P. P. Baly.  
922. A. F. Maclure.  
923. C. A. Collins.  
924. John Ramsbottom.  
925. John Gill.  
927. R. Liggett and R. Gittus.  
931. Michael Myers.  
932. T. Mallinson and P. Williams.  
935. G. T. Smith.  
936. W. & J. Keats.  
937. J. Combe and J. H. Smalpage.  
938. J. Keats and W. S. Clark.  
940. R. A. Brooman.  
941. R. A. Brooman.  
942. John Smith.  
943. James Leach.  
945. Thomas Gray.  
946. William Clark.  
947. H. A. Bonneville.  
948. Ambrose Marriott.  
949. William Spence.  
950. Henry Eaton.  
953. T. B. E. Fletcher.

956. J. Baggs and W. Simpson.  
 957. Charles Terrett.  
 959. William Oldfield.  
 960. Alex. Samuelson.  
 963. Richard Knight.  
 966. John Goucher.  
 967. R. C. Clapham.  
 970. Cornelius Turner.  
 971. B. J. Webber.  
 972. C. W. Siemens and F. Siemens.  
 976. G. A. Buchholz.  
 978. P. G. Rowell and H. Holt.  
 981. Claude Blanc.  
 984. E. W. Hughes.  
 985. A. Ford and R. Rigg.  
 986. Henry Rafter.  
 988. E. L. Simpson.  
 990. Mark Runkel.  
 991. J. W. Nottingham.  
 992. H. E. S. and J. Yeaton.  
 993. Hugh Donald.  
 995. W. C. Cambridge.  
 996. W. Campion and G. Wilson.  
 997. W. Ryan and W. Daniel.  
 998. F. E. Bryant.  
 999. Thomas Settle.  
 1000. François Durand.  
 1005. J. Lee and E. Dawson.  
 1006. G. B. Barber.  
 1009. Robert Richardson.  
 1011. William Clark.  
 1012. T. Richardson and J. C. Stevenson.  
 1013. Peter McGregor.  
 1014. John Cavanah.  
 1015. J. B. Daines.  
 1016. W. N. Wilson and J. G. Grey.  
 1023. James Thompson.  
 1024. James Thompson.  
 1027. J. H. Johnson.  
 1028. Charles Pooley.  
 1029. L. De Breanski.  
 1030. Samuel Harrison.  
 1034. J. Dunbar, junior, and J. W. Woodford.  
 1036. A. Porrier and C. Chappat.  
 1038. Charles Beyer.  
 1039. Ira Dimock.  
 1042. W. E. Newton.  
 1067. J. H. Johnson.  
 1070. Richard Butterworth.  
 1072. G. E. Donisthorpe.  
 1073. H. Y. D. Scott.  
 1074. S. S. Marling.  
 1081. Henry Worms.  
 1085. H. W. Ripley.  
 1086. Michael Henry.  
 1089. William Clark.  
 1094. J. H. Johnson.  
 1095. J. M. Gray.  
 1105. S. J. Bartlett.  
 1111. J. M. E. and C. Johnson and L. Bertling.  
 1113. George Haseltine.  
 1115. J. H. Johnson.  
 1118. Edwin Chesshire.  
 1123. J. H. Knott.  
 1126. S. B. Cochran.  
 1147. J. B. P. A. Thierry.  
 1156. William Clark.  
 1168. E. R. Clark.  
 1185. James Shanks.  
 1234. V. J. Cassaignes.  
 1242. Henry Bennett.  
 1247. Joseph Beaumont.  
 1264. Paul Addington.  
 1288. W. E. Newton.  
 1289. W. E. Newton.  
 1310. Paul Leprovost.  
 1324. Michael Henry.  
 1327. W. E. Newton.  
 1360. Valentine Baker.  
 1369. A. V. Newton.  
 1397. W. E. Newton.  
 1420. J. G. Jones and R. Ridley.  
 1425. W. E. Newton.  
 1445. W. Wells and J. W. Myers.  
 1454. C. L. Van Tenac.  
 1464. William Sims.  
 1543. T. Smith, T. Moore, and M. Burrell.  
 1599. Daniel Hussey.  
 1613. Robert Mushet.  
 1650. Frederick Ransome.  
 1670. James Oxley.  
 1701. George Haseltine.  
 1710. P. G. B. Westmacott.  
 1712. P. G. B. Westmacott.  
 1748. James Laing.  
 1761. R. Hornsby, junior, and J. E. Phillips.  
 1778. Hypolite Mège.  
 1800. G. F. Wilson and G. Payns.  
 1807. F. J. Mavor.  
 1846. Moritz Meisel.  
 1878. Nathan Thompson.  
 1881. W. E. Newton.  
 1890. R. Hoe and H. J. Cole.  
 1900. Robert Stewart.  
 1930. A. V. Newton.  
 1987. Robert Mushet.  
 1988. J. Cornforth and A. Andrews.  
 2009. S. R. Wilmot.  
 2020. P. F. L. B. Him.  
 2034. G. T. Bousfield.  
 2059. Thomas Howard.  
 2061. G. T. Bousfield.  
 2069. James Fleming.

••• For the full titles of these Patents, the reader is referred to the corresponding numbers in the List of Grants of Provisional Specifications.

# NEWTON'S

## London Journal of Arts and Sciences.

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### THE LEGAL POWER OF PATENTEES.

IN Paris there is at present being performed, with great success, a drama, entitled "*Les Ressources de Quinola*," the interest of which is centred in an inventor, who, by great study, has possessed himself of an unknown source of mechanical power. Concurrent with the acting of this fictitious story, London has witnessed in real life, and within the dreary walls of Chancery, a scene, the interest of which is also centred in the labours of an inventor, but which is far stranger, considering the period of its enactment, than the dream of the dramatic author, although it appeals less powerfully to the feelings of the public. Were it not for the clue which the names of the respective *dramatis personæ* give, we might as well refer the one story to the sixteenth century as the other. At the opening of the French play, the inventor having been thrown into prison by the Inquisition as a dealer in magic, is rescued therefrom by the indefatigable exertions of his faithful servant, Quinola, who pleads his cause before Philip II., of Spain, promising him a motive-power for his ships, that will—unlike his vanquished Armada—make him master of the seas. Fired with the thought of marine supremacy, the king lavishes on the inventor promises, the realization of which is contingent on his success, and sends him to Barcelona to work out his great problem. The troubles of the inventor now begin in earnest: arriving in Barcelona penniless, he meets only with intriguers for his secret, and opponents to his plans; and becoming involved in debt, he has to meet the threats of unpaid workmen and of disappointed money lenders, from whom he is temporarily relieved by the ingenious resources of his servant. A pretender to science, however, who is at once a negociator of bills and the author of a book on science, gleans something—words only—respecting the nature of the invention. In course of time the invention is perfected, and applied to one of the king's vessels; and its practical value having been demonstrated, the governor of Barcelona decides to confer the royal bounty publicly on the inventor.

The question is now for the first time, through a complex underplot, raised, as to who is really the inventor, and, by a stroke of female vengeance, known only to sensation literature, the honors are awarded

to the pretender to science; and the real inventor is thereby thrown into a fit of despair. From this he is quickly aroused by his faithful Quinola, who assures him that, in anticipation of this result, everything is prepared for blowing into the air the vessel fitted with the new propelling power. The defrauded inventor gives his workmen the signal, and the vessel, with its marvellous freight, is instantly destroyed. Thus, not a vestige is left of the invention, which has raised a fool to honour and made the inventor a martyr to science. The invention is thus left to die, only to be resuscitated by James Watt, at the end of the eighteenth century.

A marvellous story this, our readers will say, to be matched by facts of the present day! We think, however, that a case reported in this number, under the head *Scientific Adjudication*, and heard in Vice-Chancellor Kindersley's Court, will serve as an appropriate pendant thereto. In this we have the inventor, or rather his representative, in the ascendant, and the public the suppliant for mercy. The story is briefly as follows:—

An enterprising patentee, Mr. Foxwell by name, who is fond of law, if his antecedents in this particular are any criterion to judge by, having become possessed, by the payment of £50 to the assignees of a Mr. Charles Tiot Judkins, of a patent granted to that gentleman for "improvements in machinery or apparatus for stitching," bearing date October 16th, 1852,—proceeded against a well-known manufacturer of sewing machines for an infringement of the patent: after two failures at law, he succeeded in effecting an eligible compromise with his opponent, and on the strength of this compromise, determined to bring both manufacturers and users of the class of sewing machines in question to his feet. To this end, Mr. Foxwell recently filed no less than 134 bills against various parties, who, he alleged, were infringing his patent; that is, he commenced that number of Chancery suits, involving not merely the question of infringement, by the manufacture and use of different kinds of sewing machines, but also the validity of the patent itself, which has not yet been substantiated at law. The application made to the Vice-Chancellor was on behalf of seventy-seven defendants, who prayed, in effect, that the plaintiff should be ordered to select one suit, and carry it to a hearing, to determine the validity of the patent; and that in the meanwhile the other suits should be stayed.

But who are these seventy-seven defendants that have neglected the solicitations of the plaintiff to pay him this 40 or 50 per cent. royalties to which he is entitled on their machines? Are they not men banded together to destroy a lucrative trade established on the patent? No,—for so far as they are informed, no such trade exists. But they are for the most part tailors, shoemakers, and makers of

garments generally, who, through the exigencies of their trade, have had recourse to sewing machines—purchasing such as they found most suitable to their particular work. These people having no interest whatever in patents, or knowledge of the subtle questions they often involve, and having, in many cases, worked their honestly-purchased machines without interruption for several years, are drawn in shoals within the net of the Court of Chancery, and requested to put in answers to the several bills, at a cost, perhaps, exceeding the pecuniary claim made against them by the plaintiff; whereas, if the claim of the plaintiff were by any means shown to be a valid one, they would be most willing to stay proceedings, by cancelling the debt. The bills are virtually transcripts of one another, shaped to fit any case, and struck off from the same form of type; the names only of the parties to the suit being changed: but the replies must be individual; varying according to circumstances, and requiring each to be specially drawn and settled by counsel. The cost, therefore, of the preliminary proceedings must necessarily be very great, to say nothing of the future stages. These and other circumstances,—such as the paralyzing of the sewing-machine trade during the hearing of this interminable list of suits—one might have thought would have suggested to the Vice-Chancellor, even without the arguments of counsel, the desirableness of consolidating the suits as prayed for; but the practice of the court must be adhered to, even in this exceptional case; and the application was therefore dismissed with costs.

For a precedent for the course which Mr. Foxwell has been advised to take, we must go as far back as the time of James I., when Sir Giles Mompesson—a general dabbler in patents—and his partners, the owners of a patent for reforming abuses in alehouses, also of a monopoly for making gold and silver thread, “imprisoned many inn-keepers, who, after petitioning the king, compromised with the patentees by paying them £2000 a-year. 9000 recognizances had been returned to the Crown Office, and several cloak bags were filled with others which had been certified. They had put forty or fifty names in one writ, and one process writer, at a penny a piece, made £200 a-year by them. The Lord Treasurer, in nine several papers, had given allowance to these proceedings. The patentees, however, had not exceeded the strict letter of their grants.” Yet, notwithstanding this strict legality, the promoters of these proceedings were severely punished; their patents being annulled, and Mompesson degraded from knighthood, outlawed, and fined £10,000. This case brought about the enactment of the patent law, which confined the grant of monopolies to new inventions; and the case of Foxwell will, we trust, bring about another reform, second only to the abolition of

monopolies, viz., making the privilege of bringing actions for the infringement of patents, or otherwise proceeding to substantiate rights under patents, conditional, on proof of a *prima facie* case.

An appeal from the order of the Vice-Chancellor was made to the Lord Chancellor, who signified his willingness, when a precedent was wanting to meet an acknowledged evil, to make one, and thus to ensure the administration of equity to suitors in that court. With this view, he ordered the motion to stand over till after term, the plaintiff in the meanwhile to set forth specifically each class of infringement complained of, and the defendants to put in answers to the bills, and deposit specimens of the several machines alleged to be infringements, with the view, if possible, of consolidating the suits, and dividing them into classes. From this it appears, that notwithstanding the defects of the law, a means yet exists of curbing patentees in the use of their strictly legal powers, and fortunate it is that this is so; for what stronger case could be brought against the policy of granting patents than this proof of the power of a patentee to paralyze a whole trade which has long since become a necessity to the country? We are happy, therefore, to find that, pending the alteration of the law, which we shall not cease calling for until it is allowed, we possess in the Lord Chancellor a resource as efficient, if not so dramatic in its realization, as the brain of the faithful Quinola.

### PROPOSED CENTRAL COURTS OF JUSTICE.

THE national interests involved in the concentration of our Metropolitan Courts of Law in one locality, and the providing of suitable accommodation for the wants of the suitors, afford a sufficient plea for calling attention to a portion of the address of the Council of the *Society for Promoting the Amendment of the Law*, read at the first general meeting of the Session, relating to the carrying out of this object. No one of the many thousand persons, from all parts of the country, who have had occasion to attend our courts at Westminster or Guildhall, can have failed to see the utter inadequacy of the provisions made, both for the counsel, the jurymen, and the witnesses in attendance; and many who have had causes on for trial have experienced the difficulty of keeping their counsel and their scientific witnesses in hand; some of the counsel being, perhaps, engaged in court in Chancery-lane, while the sittings of the law courts are at Guildhall or Westminster, and the witnesses engaged being, perhaps, at chambers on pressing business, which they could as well dispatch at the

Court if there were reasonable accommodation for writing or holding consultations. The inconveniences arising from the present state of our Courts of Law and Equity are certainly a disgrace to the country; and it is, we think, with no little satisfaction that the following extract from the address of the Council of that influential society for promoting the amendment of the law, of which Lord Brougham is the President, will be read. With this introduction we leave the extract to speak for itself:—

“No measure was introduced, during the last Session of Parliament, to carry into effect the proposed concentration of the Courts and Offices of Judicature. A general expectation was entertained, that the First Commissioner of Works would have laid a Bill before Parliament, substantially similar to that which was lost almost by an accident in the previous Session. Upon inquiries made a short time before the commencement of last Session, it was found that no notices had been given for the introduction of a Courts of Justice Bill within the time prescribed by the standing orders. This Society has, therefore, been unable to take any further steps in the matter until the present time. Members will no doubt be gratified to learn, that the requirements of the standing orders will be complied with this year, and that a Site as well as a Money Bill will, in all probability, be introduced into the House of Commons. The proposal to bring together under one roof all the superior courts of law and equity, and their respective offices, is not a new question, requiring lengthened investigation, reports of select committees, or voluminous blue books of royal commissioners. All those stages have been gone through, at various periods, during the last twenty years. The late Lord Truro, when Attorney-General, obtained the appointment of a Select Committee, who reported to the House of Commons on the 22nd of July, 1842. Three years later, another Select Committee of the House of Commons, after a most careful examination of the various sites proposed, reported in favour of erecting a large central building on what has since been called the Strand, or Carey-street site. After an interval of some fourteen years, a Royal Commission was issued to inquire into the expediency of bringing together into one place or neighbourhood all the Superior Courts of Law and Equity, the Probate and Divorce Courts, the Court of Admiralty, and the various offices belonging to the same; and into the means which exist, or may be supplied, for providing a site or sites, and for erecting suitable buildings for carrying out this object. The general results of that investigation are well known. The proposals which were based upon the facts then ascertained, the estimate of the probable outlay in the purchase of land and erection of the buildings, the analysis of those estimates contained in the Treasury Minute of 1861, the document published by the Council of the Incorporated Law Society in answer to the said Minute, as well as the several Bills which have been before Parliament, prove that the attention bestowed on this subject has been of that searching and deliberate character which would justify immediate action. It is not easy to understand what can be gained by further delay. The arguments which have been employed for the last twenty years in favour of this proposal, are receiving new



illustrations, and the evils arising from the dispersion of the Courts have become every year more intolerable. Otherwise the subject has no novelty, and it appears idle to wait for more light to be thrown upon it. At the commencement of last Session, the Council, in their annual address, alluded to the financial scheme, recommended by the Royal Commissioners, for carrying out the projects of concentrating the Courts. It was then stated that certain retiring allowances, chargeable upon the interest of the two principal sums proposed to be used, would probably fall in, and altogether disappear, in the course of some fifteen years. Taking the year 1862, it seems that the annuities which have lapsed show a more rapid disappearance of claims upon this fund than was estimated. It has been suggested, that if the actual expenditure should exceed the estimated cost, as suggested in the Treasury Minute of 1861, a supplemental fund might very readily be raised, by levying a trifling tax upon the writs issued out of the Common Law and Divorce Courts. It has been calculated that a stamp duty, amounting to 3s. 4d. upon each writ, would realize somewhere about £16,000 a-year, and that a duty of 10s. upon each probate of wills above £100, amounting in number to some 30,000 every year, would produce £17,000. These two sums would be sufficient to pay the interest upon a million sterling—sufficient to cover any possible excess over the estimated cost of purchasing the site and erecting the building. Whatever may be thought of the latter proposal, it would appear that the project of erecting a convenient central building, in which the whole business of the Superior Courts might be transacted, is one that might undoubtedly be carried into effect without incurring serious pecuniary risk."

### Recent Patents.

*To WILLIAM HENRY EMETT, of St. George's-terrace, South Kensington, for improvements in processes for facilitating and combining the art of writing with engraving together on stone; applicable to maps, plans, specifications, and other lithography; which improvements are also available for re-transfers to zinc or stone, or printing from original.*—[Dated 17th March, 1863.]

THE lithographic stone is prepared by first graining, as for chalk drawing; the surface of the stone is then polished, after which it is pumiced, taking care to keep the surface free from dust. The face of the stone is then covered over evenly with strong gum, and allowed to remain for some few hours, say from six to ten hours. When the tracing is completed of the work to be drawn, the gum is removed from the stone by washing almost the whole from the surface with a clean sponge. The stone should now be fitted in a lithographic press, and the surface be damped with a little water, remembering to leave no water on the stone more than necessary for securing a good copy of the tracing. The tracing is then placed on the stone reversed, as is usual for a transfer in lithography, and pulled quickly through the press: the im-

pression will be found much firmer if pulled twice without lifting up the tympan. The impression will then be transferred on to the stone, and quite fit for the engraving and ink work. The tracing must be made by using ivory black, mixed up with a little water of about the consistency of lithographic ink, and a lithographic crow quill; or any pen that will produce a good firm line, should be used, as the firmness of the tracing insures the better quality of work when transferred from tracing paper. In commencing the drawing and writing, the thick lines of the latter are to be executed first, then the thick or shadow lines of drawing. The work thus described must now be etched very slightly with a little weak diluted nitric acid and gum water. Care must be taken not to etch away the tracing that, up to the present, is not drawn. When the stone is quite dry, it should be slightly covered with a little red or black chalk, usually employed for showing the fine engraved lines on stone; the fine lines of writing and drawing can then be engraved with an ordinary stone engraver's point or diamond, if necessary. When all the work is finished, the surface of the stone should be covered with a coat of sweet oil, to remain on the stone from five to ten minutes, and then removed with a clean sponge. The work is to be rolled up distinctly by a good soft roller,—those generally used for printing stone engraving will be found suitable for the purposes of this invention. The work thus executed is fit for making re-transfers to stone or zinc.

The patentee claims, "the processes for facilitating and combining the art of writing and drawing in lithographic ink with engraving together on stone, applicable to maps, plans, specifications, and other lithography; being also available for re-transfers to zinc or stone, or printing from original, substantially as described, or any mere modification or imitation thereof."

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*To WILLIAM SYMINGTON, of Market Harborough, Leicestershire, for improvements in the process of, and apparatus used in, roasting and treating coffee and other organic substances.*—[Dated 18th March, 1863.]

THIS invention consists in an arrangement of apparatus, whereby the aroma, volatile oil, and other products evolved during the process of roasting coffee, cocoa, chicory, and other substances, and which is allowed to escape and be wasted by the method at present in use, is saved and utilized. The coffee or other substance is roasted in cylinders or vessels which can be made either to communicate with the open air, or with one or more closed chambers or vessels at pleasure. In these closed chambers cold roasted coffee, or nibbed or dried chicory, or other suitable substance, either powdered or otherwise, and in a desiccated or dried state, is placed. These desiccated substances are placed, by preference, upon shelves or trays, or in such other manner, that the vapor, volatile oil, aroma, or other product evolved during the process of roasting coffee or other substance, passes over or through them, or is brought into as close contact as possible with them, and is absorbed by them, and thereby fixed and rendered available. In order also to prevent the waste of that portion of the aroma or volatile oil which remains in the cylinder in which the coffee is roasted, when the process of roasting is completed, and which would be lost if the cylinders were immediately opened and dis-

charged, a portion of coffee which has been previously roasted and become cold, is introduced into the vessel with the hot roasted materials. This is allowed to remain in the cylinder for a period of from ten to fifteen minutes, and thoroughly mixed with the hot roasted material, when it absorbs the last portions of the aroma or volatile oil which remained, and the whole can then be discharged.

It is known that a very large proportion of the aroma or volatile oil, which gives the specific flavour to coffee and other vegetable substances, is wasted during the process of roasting, and it is proposed not only to save this by causing it to be absorbed by dried chicory or other substance, but also to pass these volatile products, evolved during the process of roasting the best coffees, through roasted or dried coffees of inferior quality, thereby improving their flavor, and preventing a waste which has hitherto amounted to a large per-centage of the whole quantity contained in the berry. The patentee remarks, "that in roasting coffee by this improved process, it is preferred to allow the products which are evolved during the early part of the process, or until the berry begins to change color, to pass into the open air, as they consist principally of vapor of water and an acid product, which is not at present of any value."

The patentee claims, "the method of saving and utilizing the aroma, volatile oil, and other products evolved during the process of roasting coffee, cocoa, chicory, and other organic substances, by combining the cylinder or vessel in which they are roasted, with one or more receivers or vessels containing cold roasted coffee, or nibbed or dried chicory, or other suitable substance, either powdered or otherwise, and in a desiccated or dried state, by which the aroma or volatile oil is absorbed and rendered valuable."

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*To FEDOR DE WYLDE, of Trinity-square, for improvements in the manufacture of cement from gypsum.*—[Dated 20th March, 1863.]

THE gypsum is first roasted in an oven, to drive off the water, and then broken into small lumps and soaked in a solution composed of silicate of potash, with such an equivalent of carbonate of potash as will not precipitate the silica, such as the following proportions:—Thirty-one ounces of silicate of potash, and nine ounces of carbonate of potash to one gallon of water. For ordinary cement this solution may be used in the proportion of one part of the solution to two parts of water. In cases where a slowly-setting cement is required, sulphate of potash may be used in combination with the carbonated alkali. The gypsum, after having been soaked in this solution for twenty-four hours, may be removed from the macerating tubs, and allowed to remain at rest in compact masses, for the more perfect diffusion of the solution through the gypsum. It is then again roasted, at a temperature of from 300° to 400° Fahr., for the purpose of again drawing off the water. The material is then ground to the requisite degree of firmness. Color may be introduced into the material when required for decorative purposes.

The patentee claims, "the manufacture of cement from gypsum, with the solution of silicate and carbonate of potash, in the proportions, and under the conditions, mentioned."

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To HENRY DIRCKS, of *Blackheath*, and JOHN HENRY PEPPER, of the *Polytechnic Institution*, for improvements in apparatus to be used in the exhibition of dramatic and other like performances.—[Dated February 5th, 1863.]

THE object of this invention is, by a peculiar arrangement of apparatus, to associate on the same stage a phantom with a living actor, so that they may act in concert; but which is only an optical illusion as respects the one or more phantoms so introduced.

The arrangement of the theatre requires, in addition to the ordinary stage, a second stage, at a lower level than the ordinary one, hidden from the audience as far as direct vision is concerned; this hidden stage is to be strongly illuminated by artificial light, and is capable of being rendered dark instantaneously, while the ordinary stage and the theatre remain illuminated by ordinary lighting. A large glass screen is placed on the ordinary stage, and the hidden stage is placed between the glass screen and the audience.

In Plate XI., fig. 1 is an arrangement showing a stage with part of the pit, in section, for carrying this invention into effect. *a, a*, is an opening formed in the ordinary stage. In the front part of the stage, but at a lower level, is a hidden stage *b*. The opening *a*, is capable of being closed at top by trap doors, as shown: when the trap doors are closed, the actors on the ordinary stage can pass freely to and fro above the lower or hidden stage. The actors or objects corresponding with the phantom image, which it is desired to represent to the audience, are on the lower stage *b*, and are strongly illuminated by the lime light or electric light, or other powerful illuminating means. This light must accompany the actor in any movement he has to make. The hidden stage *b*, and lanterns *c*, may be mounted on a carriage on rails, a plan of which is shown at fig. 2, so that when it is necessary for the phantom actor on the lower stage to be moved, the lanterns may be caused to move also; or the lanterns may remain stationary whilst the actor moves, provided the whole space through which he moves be sufficiently illuminated. The lanterns are to be provided with means for instantaneously extinguishing or masking the light, and for reproducing it, so that the phantom may be made to disappear and reappear at pleasure, whilst the audience and the ordinary stage will be more or less lighted in the ordinary manner, according to the effects desired to be obtained. For this purpose a board *b*<sup>1</sup>, is employed, which is capable of being raised into the position shown by dotted lines, so as entirely to cut off the light from the hidden stage when desired; or an ordinary opaque shade attached to each lantern may be used for the purpose; or, when using the lime light, the desired effects are caused by gradually or instantaneously extinguishing or masking off the supply of gases, and the phantom image may, by any of these means, be caused gradually or instantaneously to fade away. When the trap doors over the hidden stage are open, the part *d*, thereof assists in hiding the lanterns and the opening from the audience. The part *e*, is raised into the position shown, and acts together with the part *d*, to screen the lanterns from the audience, and also to ensure that any actor on the hidden stage shall not accidentally appear above the level of the visible stage. The phantom actor, when standing on the stage *b*, leans against the screen *k*, which is inclined so as to be parallel with the glass

screen, and is covered with black velvet, as is also the stage *b*, in order that no image of either the screen *k*, or the stage *b*, may be seen in the reflection. *f*, the glass screen, is a large sheet of plate glass on the ordinary stage, of sufficient size to reflect the full length of the actors or objects on the hidden stage to the audience in the pit, boxes, and galleries of the theatre. The hidden stage is between the glass and the audience. The glass may be mounted in a swing frame, so that it may be adjusted to the angle required, which may readily be done by screws, or ropes and pulleys. The glass screen is to be set at such an inclination as to bring the reflected image to the level of the ordinary stage. This will enable the spectators, whether in pit, boxes, or gallery, to see the reflected image without any obstruction to the view above the foot lights, and it will be visible from all parts of the house. The proper angle of inclination of the glass is ascertained experimentally by having persons in the different parts of the house to say when the image is shown them correctly. The scenery is so disposed as to conceal the frame of the glass, and it is preferred that the glass should be able to descend into an opening or box *g*, beneath the stage, in the position shown, by means of a rope *h*, by which, aided by the bolts *i*, the glass is supported in the required position. The glass may either be adjusted when screened from the audience, and remain in position during the scene, or (the proper angle of inclination having been previously ascertained by experiment) the glass may be raised on to the ordinary stage, and placed in position, whilst the scene is before the eyes of the audience under a subdued light, without the movement being observed; for which purpose the top bar of the frame of the glass should be made very light, or be omitted altogether. This arrangement admits of an actor on the visible stage passing across the space which the glass is to occupy; and this he can do just before the appearance of the phantom; then the glass is run up immediately, the trap doors are opened, the actor or image on the hidden stage illuminated, and the phantom appears. This arrangement will render it less likely that the audience should imagine that there is anything interposed between them and the actors than if the glass plate remained permanently in position during the scene. The hidden stage may be provided with a well or hole, up which an actor can rise; he will then appear as a spectre rising out of the visible stage. The lanterns may be provided with colored glasses inside, to heighten the effect. As the actors on the ordinary stage do not themselves see the spectral image, marks should be placed on the stage, or other indications made, in order that they may know the position which the spectres, appearing to the audience, are to occupy. In order to appear upright upon the visible stage, the actor on the hidden stage should be inclined so as to be as nearly as practicable parallel with the surface of the glass screen. In effecting this, assistance is afforded by the screen *k*, of the hidden stage. Several sheets of glass may be similarly employed at the same time if one is not of sufficient width to cover the different parts of the stage at which it is desired that the spectre should appear; the interval or junction being concealed by the introduction of a tree or column, or some other piece of scenery.

The patentees claim, "the combined arrangement, as herein described, of a glass inclined forwards towards the audience, and two stages,—one the ordinary visible stage, and the other a hidden stage at a lower level

than the ordinary visible stage, and illuminated with a much stronger light than either the ordinary visible stage or the body of the house; and which light is capable of being instantaneously, or, if so required, gradually, withdrawn and restored."

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To HENRY EDMONDS, M.D., of Peel Lodge, Stoke-road, Gosport, for improvements in the ventilation of ships and vessels, and apparatus connected therewith.—[Dated 26th February, 1863.]

THIS invention consists in ventilating ships by means of, and through a system of, shafts and air channels, designed to act upon those parts of a ship's interior where ventilation is most necessary, and for which purpose they are peculiarly adapted, acting as they do directly upon them. Those parts are—the upper spaces of inhabited decks between the beams, cabins, store-rooms, and magazines, the bilges, and those channels between the inner and outer planking or plating of the ship separated from each other laterally by the upright timbers or ribs extending from above downwards to the bilges. These channels are ordinarily called the "openings" or "timber spaces," and it is highly desirable that they should be ventilated, for the preservation of the ship's frame timbers from decay or "dry rot," as well as to prevent their damp exhalations, together with the foul air from the bilges, being vented, as is now usually the case in merchant ships, through the "list piece" space along the ship's side internally into the mess or cabin deck room, or, as in ships of war, through open spaces above the shelf pieces between the beams of the same deck and close to where the sailors sleep in hammocks at night, where the greatest care should be taken to preserve the air from contamination. Through the first part of the apparatus the action of those "openings" is reversed, and they are converted into most efficient means for carrying off the foul air from the inhabited decks as well as from the bilges. To effect this they are connected together by constructing longitudinal shafts or enclosed air passages along the ship's sides, externally or internally, of thin sheet metal, or of wood, or of both combined, having communication by means of an aperture of regulated size, proportioned to their number and the size of the shaft, into each of the openings between the timbers: a circular hole of about two inches diameter is considered sufficient for each in a large ship. These "openings" or channels thus become so many branch air passages, from about 100 to 150 in number on each side,—acting by their upper extremities on the most impure air of the mess and cabin deck, and by their lower extremities on the foul air of the hold and bilges: all their other outlets should be carefully closed, but the openings may be also communicated, by means of apertures or connecting tubes, with any compartment requiring ventilation. The longitudinal shafts may be used either independently of, or in connection with, the second part of the invention next described. For one or more planks, or any portion of them forming the ceiling of the deck to be ventilated, on each side of the ship is substituted a hollow channel or air passage, extending for all or any part of its length ordinarily level with the deck above, but which may be made slightly arched or projecting above. The material preferred in the construction of these channels is iron or brass, or it may be wood only, or strengthened with metal. These deck

air channels should have perforations below, so as to communicate with every space between the beams of inhabited decks and cabins where impure air naturally collects. Connected with each perforation may be a small transverse air channel, with smaller perforations, so as to diffuse its action.

In Plate XI., fig. 1 represents a section of a sailing ship, on the right or starboard side *a*, and on the other *b*, of a steam ship: its communications with the openings *d*, and the direction of the current through them, is shown by arrows; being downwards from the mess and cabin deck at *f*, and upwards from the bilges at *e*. The foul air from these sources next passes into the cross shaft *g*, which in steamers may unite with the deck channel at *h*; and the combined shaft enters the funnel at *i*, by a valved opening, so arranged that on the valve *k*, being closed, either by a communicating wire passing through the funnel casing, or by lifting the moveable cover shown at *l*, the draught may be shut off from entering the funnel, and passed up the funnel casing at *q*. In the sailing vessel, the longitudinal shaft *c*, only is shown carried along over the list piece, covering this in, and communicating with the openings by apertures of graduated size through a thin casing over them, so as to diffuse the action of the shaft equally. The means of ventilating them here shown is through vertical tubes with cowls, from one to three on each side, *p, p, p*, ordinarily with the cowl reversed from the wind, but when a dry wind is blowing, the cowl may be faced to it; fresh air will then be circulated through the whole framework of the ship, acting as uptakes; damp will be carried off, as well as all foul smells from the bilges and hold; and dry rot prevented.

Figs. 2, 3, and 4 are specimens of practical modes of constructing the deck air channels; the material used at *m, m*, being iron or brass. Fig. 2 is specially adapted for ships of war, being of great strength; figs. 3 and 4, being lighter and more easily constructed, are adapted for mercantile vessels. All of them serve also as stringer plates, greatly strengthening the ship longitudinally. The channel of which a longitudinal view is seen in fig. 5, is completed below between the beams with thin sheet iron or zinc *r*, perforated at *u*, and communicating with small cross channels, a section of which is shown at *n*, formed by enclosing an angular space between the beam and deck, also perforated as at *s*, so as to diffuse the action of the deck air channels. In fig. 1, *w, w*, in dotted lines, shows another arrangement of the longitudinal shaft, being here placed along the ship's side, beneath the mess deck, or it may be at a still lower level. The communicating cross shaft is more conveniently carried downwards till near the floor of the boilers, between two of which it should pass, and divide opposite the ash-pits of their furnaces into two short branches, and enter them beneath the fires by a valved opening *x*. The deck air channels *o*, are shown in section on the steamship side.

The patentee says:—"I do not claim any originality in the ventilating powers I have availed myself of, but only in using them in connection with the whole or any part of the system of air shafts and channels, invented by me for the purpose of ventilation that I have described; namely, the first part of my apparatus, which I have called the 'longitudinal' or 'openings' ventilating shaft, and the second part or deck air channels, of whatever materials these may be constructed, whether used in *steam* or in sailing ships or vessels, separately or combined, I claim them,

and ventilation by means of them, as my invention, in whatever manner foul air may be extracted through them, or fresh air introduced into them for ventilating purposes."

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*To THOMAS EDWARD SYMONDS, of Adam-street, Adelphi, for improvements in the construction of screw-propelled ships, and in the arrangement and mode of disconnecting, withdrawing, and lifting screw propellers.*—[Dated 28th February, 1863.]

THIS invention relates to twin or double-screw ships built of iron, and having one or more keels, each screw being overhung or having no outer bearing.

In constructing ships according to this invention, two transverse bulkheads are formed across the stern part of the ship, the aftermost of these bulkheads being immediately before the screw; and a well-hole is formed for receiving each screw, under the counter, and abaft the transverse bulkhead.

For the purpose of enabling overhung screws according to this invention to be raised vertically, each screw is mounted upon a short length of shaft, which is supported by, and free to revolve in, a long bearing formed by two half carriages, which, when brought together, form a tube, which may be filled with lignum vitæ strips or other bearing and wearing surfaces. These half frames, when combined, form the carriage, and which sliding in a vertical frame or guides between the transverse bulkheads enables the screws to be raised vertically, so that the ship may sail without the obstruction offered by the screw propeller. Each screw may be raised separately. The inner end of the short shaft, upon which the screw is mounted, may be fitted with the ordinary form of "cheese-head" coupling. The withdrawing the screw from the water, or the raising and lowering, may be effected by means of chains or ropes and pulleys, or any other of the well-known mechanical means may be adopted for that purpose. The foremost of the transverse bulkheads is fitted with a stuffing box for the screw shaft, and one part of the cheese-head coupling projects therefrom. The apertures for the screws are fitted with flaps or shutters opening outwards (or they may be made to slide), for the purpose of closing the opening at the bottom of the screw hole, so as to insure a clear delivery of the water, whether under steam or sail. The overhanging end of the screw or one of the blades may have a hole cast or formed therein, for the purpose of enabling the screw to be "fished," or to assist in withdrawing it or hauling it up.

For the purpose of withdrawing the overhanging screw horizontally from off the screw shaft in double-screw vessels, the after end of the screw shaft is formed in the following manner:—The shaft is made at the outer end sufficiently large to enable it to be bored or otherwise made hollow, for the purpose of receiving the shank of the screw, or a short length of shaft upon which the screw has been fitted; and a gib and cotter passes through slots formed in both the screw shank or shaft and the hollow part of the main shaft within or forward of the stuffing box, or between the outer and inner bulkheads, or forward of the stern bearing; thus the key or other means of securing the overhanging screw in its place may be withdrawn, and the screw released.



In Plate XI., fig. 1 is a longitudinal section, and fig. 2 an elevational stern view, in two sections, of a double-keel iron ship, having two screws and two rudders fitted according to this invention in a ship of large size suited for war purposes.

In the two sectional views in fig. 2, the one is so taken as to show the screw in its usual position, and also the trunk or space up which the screw shaft travels; the other section shows the screw raised, the screw well-hole, and the cheese-head coupling or bearing in the trunk or box projection, which springs from the keel, for the purpose of receiving the outer length of screw shaft.

Fig. 3 is a longitudinal section of part of the stern portion of an iron vessel of light draught, with two screws, showing the mode of fitting any form of screw which may be preferred to the screw shaft, for the purpose of disconnecting by drawing off horizontally; access to the outer end of the screw shaft being given by increasing the width of the trunk up to the skin of the ship by splaying out, so that the gib and key may be readily withdrawn, and the screw with its short internal shaft or shank may be drawn out horizontally. The stern lines of the vessel shown in this view are, however, only ideal, and are not intended to convey the exact form which it may be desirable to adopt; but this figure is given solely as an illustration of a mode of fitting screws in double-screw ships, and of the combination of a rudder or rudders therewith.

Fig. 4 is a transverse section of fig. 3, showing an arrangement of engines for driving the two screws independently, to admit of manœuvring the vessel with or without the aid of the rudders; and although in this section a peculiar arrangement of engine is shown, in which it is intended to employ two pairs of engines (each of two cylinders), and wheel gearing is also intended to be employed for allowing of the engines working slowly, such an arrangement is only shown by way of illustration, and not as a plan which it is preferred to employ in ordinary cases either in commercial ships or in vessels of war.

Fig. 5 is a detached view, showing the mode of fitting the screws to screw shafts to admit of their being drawn off horizontally. A, is the transverse bulkhead before referred to in the stern portion of the hull, and which is in every case carried up above the deep load line, and in vessels of light draft it is proposed to carry it up to the deck line in screw ships where the screw is raised vertically; B, is the narrow trunk or space in which, in double-screw ships having overhung screws, the short shaft and the main bearing are made to slide or travel up and down, as shown; C, is the well-hole, in which the screw is raised and withdrawn, when out of use, from its working position; D, the screw, which may be varied in form; E, the shaft upon which the screw is mounted, and which shaft may be fitted and moved and detached from the screw in either manner described above; F, the keel of the single-keel double-screw ship; and F<sup>1</sup>, F<sup>1</sup>, the keels of double-keel ships. G, G, are the rudders of double-keel double-screw ships, the mode of working these rudders being shown; H, an arrangement of horizontal engines and gearing for driving the two screws, which may or may not be adopted; a, a, are flaps for closing the screw well-hole; and b, the long bearing and carriage containing the short length of screw shaft, and which is so fitted as to slide vertically into and out of gear with the cheese-head coupling on the screw shaft. c, and c<sup>1</sup>,

are the pulleys or sheaves for lifting and lowering the screw ; *d*, the tiller of the rudder ; and *e*, the thrust block of the screw shaft.

The patentee claims, "First,—the mode of constructing ships, as described, for receiving two screws, and enabling them to be readily lifted. Second,—the mode of applying or fitting screw propellers in double-keeled double-screw ships, as described. Third,—the mode described of applying, mounting, and fitting two screws to single-keel ships, so that the screws may be readily raised when out of use. Fourth,—the mode of constructing the stern portion of double-screw ships, and of combining therein and therewith the arrangements for propelling and steering, as described."

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*To JOHN PENN, of Greenwich, for improvements in escape or relief valves to the cylinders of marine and other steam engines.*—[Dated 28th February, 1863.]

ESCAPE or relief valves are now commonly fitted to the cylinders of marine and other engines, to allow of the escape of water should any be carried over from the boilers, or otherwise get into the cylinders, and these valves hitherto have had to be loaded by weights or springs to an extent greatly exceeding the pressure of the steam in the boiler, to prevent the inconvenience of the steam escaping into the engine room, more especially when the engines are worked expansively by the link motion, or suddenly reversed ; as in these cases the steam becomes compressed or jammed to a considerable extent towards the end of the stroke by the lap or cover on the slide valve, producing an undue and severe strain on the machinery, particularly in engines where the slide valves are prevented coming off their faces, by being fitted with packing on the back, to relieve the pressure on the faces. Instead of weights and springs, the patentee proposes to employ the pressure of the steam to keep the escape or relief valves in their seats.

In Plate XI., fig. 1 shows a section of a steam cylinder of a double-trunk engine ; and fig. 2 shows an end elevation, partly in section, with the arrangement or combination of parts employed for carrying out the improvements. *A, A*, are the steam cylinders ; *B*, is the main steam pipe, for supplying steam thereto from the boilers ; *C*, is a chamber, into which the steam is conducted from the boilers ; this chamber is divided to some extent by the partition *c*, under which the steam passes before it enters into the main steam pipe *B*, as is indicated by the arrows ; *D, D*, are passages from the two ends of each cylinder *A*, which communicate with valve boxes *E, E*, in which are valves *F, F*, which are constantly pressed towards their seats by steam acting on their outer surfaces. The valve boxes *E, E*, are connected to each other and to the chamber *C*, of the main steam pipe by pipes *G, G* ; hence, when water is driven through any of the passages *D, D*, from the steam cylinders, it will overcome the pressure of the steam acting on the valves, and will pass away by the pipes *G*, to the chamber *C*, where provision is made for drawing off the water.

The patentee claims, "the mode described of arranging the escape or relief valve apparatus of marine and other steam engines."

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*To WILLIAM GRAY, of Sheffield, for improvements in the manufacture of beaters for thrashing machines.*—[Dated 27th February, 1863.]

THIS invention consists, firstly, in rolling steel of any description, or wrought iron, in the shape or design shown in the figure in Plate XI., and the application of such rolled steel or wrought-iron bars as beaters for thrashing machines on the drum, concave, or breast plate.

Secondly, the invention consists in fluting or grooving in steel or wrought iron the surfaces of the longitudinal bars of the beater in the manner shown. The parts grooved or hollowed out underneath are merely for the purpose of reducing the weight.

The patentee claims, "the improvements in the manufacture of beaters for thrashing machines, as described."

*To AIMÉ FRANÇOIS PAGNY, of Paris, for a new agricultural implement for cultivating tubercles, roots, and all oil plants.*—[Dated 2nd March, 1863.]

THE agricultural implement forming the subject of this invention is a ridge or bouting, and at the same time a roller plough. It is shown in Plate XII. as composed of a ploughshare with double mould board (smaller than for ordinary bouting ploughs), and of four conical rollers acting on the inclined plane of the ridges. The share, the main object of which is not the bouting or ridging, breaks the subsoil, cleans the water furrows, and thus prepares the work of the rollers, which follow it. The two first, which are placed on each side the mould boards, simply dress the earth; the two latter, on the contrary, which are more open, more inclined, and placed higher, press or settle down the earth, and form the ridge. Four iron rods, hinged at *s, s'*, serve for axles, and receive four reversed conical rollers, that is to say, with their heads downwards. These rods slide freely at their upper part in two cross pieces, which may be compared to the legs of a compass. The legs at the head of this compass are about twelve inches apart behind the share, and the two branches, about twenty-eight inches long, play at their ends on a cross piece. A screw permits the opening to be adjusted at from sixteen to twenty-four inches, according to the greater or lesser pressure required. The inclination of the rollers is only equal two by two, because the fixing point at the base is the same, and the spreading apart of the points of the compass is more or less developed. Lastly, a wheel *g*, about eight inches in diameter, placed at the back of the plough, relieves the arms of the labourer, and it is this wheel *g*, which keeps the two last rollers at an elevation of, say, four inches, in order that they may more easily form the ridge.

*a*, is a hook for harnessing; *b*, wheel which regulates the depth of the ploughing; *c*, ploughshare; *d*, double mould boards for bouting; *e*, compass head; *f*, branch of compass; *h*, pin which regulates the setting apart; *g*, hind wheel; *r*, rollers, and *s, s'*, the points where the rollers are hinged.

To WILLIAM ALLEN, of *Cheadle, Cheshire*, and WILLIAM JOHNSON, of *Newton Moor, in the same county*, for certain improvements in machinery or apparatus for grinding cards employed in carding engines.  
—[Dated 5th March, 1863.]

THIS invention relates to the small carding surfaces employed in carding engines generally attached to a continuous chain, and termed "flats," and is designed for the purpose of grinding the surface of such cards in an even and true concave form, or in any other form desired.

The improvements consist in the use of a guide, or peculiar shaped groove, to cause the flat to approach and recede from the grinding cylinder at certain intervals, so that such guide governs the superficial form into which the surface of the flat is ground. The form of the groove or guide will depend upon the particular form to which the flat is to be ground, whether truly vertical, simply curved, or S-shape, or diagonal.

In Plate XII., fig. 1 represents an end elevation of the apparatus for grinding and pointing the cards termed flats employed in carding fibrous materials, such view showing particularly the curved slot, by which means the shape into which the surface of the flats are to be ground is defined and regulated, and also shows one method of applying a reciprocating motion thereto; fig. 2 is a front elevation of the grinding roller and flat. *a, a*, is the framing of the machine, in which is supported the driving shaft *b*, which drives, by means of the strap and pulley *c*, a right and left-handed screw, and causes the roller and cylinder *d*, to traverse from end to end of the two flats *e, e*. The grinding roller *d*, may either be used and constructed as shown, or it may be employed without a corrugated surface, as hitherto used, and is situated between the two flats to be ground, which are secured at the ends of the vibrating bars *f, f*—one end of such bars being supported in the bearings *g, g*, and self-adjustable therein by being simply attached to the cord or weight which allows of any slight rise and fall. The course or curve which these bars, and consequently the flats, are caused to follow, is regulated and defined by means of the curved (or straight) slots in the guides *h, h*: the surface of such flats is ground into a form corresponding to the form of the guide employed. The pressure of the flats against the grinding roller is obtained by means of the springs *i, i*, the amount of pressure being regulated by the ratchet and pawl *l*, by means of which the flats *e, e*, are prevented from becoming pressed too closely upon the grinding roller. The grinding roller is driven by means of the band and pulley *c*, from the driving shaft *b*, and the vibratory motion, or rise and fall of the bars and flats, is effected by the crank studs on the spur wheels *m, m*, which are driven by a pinion on the driving shaft *b*. The advantages arising from the employment of "needle-pointed" cards in the carding engine, instead of the "chisel-pointed" as usually ground, together with the use of flats having their carding surfaces grooved truly to any required form, will be evident to all persons conversant with preparing and spinning cotton.

The patentees claim, "the novel application and adaptation of a suitably-shaped guide or groove, to cause the flat to approach and recede from the grinding roller at certain required intervals, so that such guide may govern the superficial form into which the surface of the flat is to be grounded, as described."

*To JAMES TOMLINSON, of Rochdale, for improvements in machinery for opening twisted yarns and woven fabrics.*—[Dated 11th March, 1863.]

THIS invention consists in the application of two or more feeding apparatus to the main cylinder of the ordinary hard waste breaking and finishing machine; each feeding apparatus being fitted with two feeding rollers, or with one feeding roller and a concave trough.

In Plate XI., fig. 1 is a sectional elevation of an ordinary hard waste breaking and finishing machine, for opening twisted yarns and woven fabrics, to which the improvements are applied. *a*, is the main cylinder, covered with spikes or teeth; and *b*, the wire cage; *c*, the lower feed roller, revolving in a concave trough *d*; and *e*, the lower feeding apron: these parts are made in the usual manner.

The improvements consist in the application of additional feeding apparatus to the present machines, for the purpose of increasing the produce and performing the work more effectually than heretofore. *f*, is the upper feed roller, revolving in the concave trough *g*; and *h*, is the upper feeding apron, which is placed in a slanting direction, to give more space for the attendant to spread the twisted yarns and woven fabrics, or other articles, on the lower apron *e*. Both the feed rollers *c*, and *f*, are turned round simultaneously, being connected together by the pinions *c*<sup>1</sup>, and *f*<sup>1</sup>, and the carrier wheel *i*, shown by dotted circles. Each feeding apparatus can be adjusted so as to be brought closer to, or further from, the teeth of the main cylinder, by regulating screws of the ordinary construction; and the gearing for driving the feed rollers is connected to a reversing motion of the usual construction, so as to be able to back out the feed of each feeding apparatus at the same time.

When the machine is in operation, the attendant spreads the articles to be operated upon on the feeding aprons, which deliver them to the feed rollers, by which they are presented to the teeth of the main cylinder. The opened fibres are thrown off the main cylinder, and deposited on the partition *k*, and against the surface of the wire cage *b*, under which is the delivering roller *b*<sup>1</sup>; and the fleece of opened fibres, after passing between the wire cage *b*, and roller *b*<sup>1</sup>, drops on to the floor, or into a suitable receptacle, in the ordinary manner.

Fig. 2 shows a concave feeding trough, of the ordinary construction, to which is attached a cross bar *j*; this cross bar may be of any required thickness, according to the length of staple of the articles to be opened. When the staple is very short, no cross bar is required, and the concave trough is brought close up to the points of the teeth of the main cylinder; but when the staple is longer, a cross bar of the requisite thickness is attached to the front of the concave trough.

The patentee claims, "the application of one or more additional feeding apparatus to the main cylinders of hard waste breaking and finishing machines, and also the mode shown in fig. 2, for adjusting the feeding trough according to the length of the staple or the nature of the material to be operated upon."

To JOHN HARRIS and JOSEPH BUTLER, both of Pontypool, Monmouthshire, and JOHN HENRY FRASER, of Llanvrechva, Upper, in the same County, for improvements in machinery for rolling armour plates, bridge plates, boat plates, and other plates and bars of iron.—[Dated 13th March, 1863.]

THIS invention consists in constructing and arranging rolls in the manner hereinafter explained, whereby lateral pressure is applied to plates and bars of iron during the rolling process, and the plates or bars are fed to, and conducted from, the rolls, in a simple and expeditious manner.

In Plate XII., fig. 1 represents, partly in end elevation and partly in transverse section, the improved machinery for rolling armour plates, bridge plates, boat plates, and other plates and bars of iron; and fig. 2 is a plan of the same, with the top roll removed. *c, d*, are the pair of rolls working in bearings in the standards *e, e*; the bearings of the upper roll being acted upon by the screws *f*, to adjust the distance between the rolls *c, d*, in the ordinary manner. The upper roll *c*, is shorter than the lower one *d*; the said lower roll projecting on either side the upper roll. On the outer sides of the standards *e, e*, and near the level of the acting surfaces of the rolls, are projecting boxes *e'*, in which boxes recesses are made, the said recesses extending through the standards *e, e*. In the recesses are the rotating collars *g*, and the gearing of the said rotating collars. The rotating collars *g*, turn upon axes, carried by a frame, adjustable in the following manner:—On either side and in front of the recesses in the boxes *e'*, and standards *e*, vertical bars *h'*, are fixed, the said bars being secured to the standards by the screw pins and nuts *i*. In the bars *h'*, set screws *k*, work, the ends of which bear against the frame *h*, carrying the rotating collars *g*, and keep the rotating collars to their bearing against the ends of the upper roll *c*. The lower face of each of the rotating collars *g*, rests on the cylindrical surface of the lower roll *d*, and the cylindrical surfaces of the collars bear against the ends of the upper roll *c*. By means of the rotating circular collars *g, g*, the edges of the plate or bar being rolled, are prevented from spreading laterally, and the edges are subjected to the same pressure, or nearly the same pressure, as the other parts of the plate or bar, each time it is passed through the rolls *c, d*. Great density and uniformity and excellence of quality in the rolled plate or bar thereby results, and a rolled and skinned edge is obtained, which is very desirable for rivetting purposes. When a plate is required to be rolled of a width greater or less than the width of the upper roll *c*, it is only necessary to change the upper roll for one having a length equal to the width of the plate to be rolled. The lower roll *d*, being always longer than the upper roll, does not require to be changed on changing the upper roll *c*. On changing the upper roll *c*, the rotating collars *g*, are adjusted against the ends of the newly introduced upper roll, by means of the set screws *k, k*. The upper roll *c*, can be raised or lowered in the standards *e, e*, by means of the screws *f*, without interfering with the rotating collars *g, g*, and lower roll *d*. In order to guide the plate to and from the rolls *c, d*, guide rollers *l, l*, are placed at each side of the rolls, and provided with loose or moveable collars or flanges *m, m*, which are capable of sliding on the rolls. The collars *m, m*, are so adjusted and fixed on the rolls, that the distance between them is equal to the width of the plate to be rolled. Rotatory

motion is communicated to the guide rolls *l*, by means of a toothed wheel fastened on the end of the top pinion of the pair of pinions which give motion to the top roll: the toothed wheel works into another wheel fastened on the shaft connected to the guide rolls by means of coupling boxes or crabs. The guide rolls *l*, *l*, rotate in the direction proper to carry the plate resting upon them through the rolls, the rate of motion of the guide rolls being the same as that of the rolls *c*, *d*. On guiding a plate to the rolls by means of the rotatory guide rolls *l*, *l*, the end of the plate is presented parallel to the axes of the rolls, and the plate, on leaving the rolls, is preserved straight, and prevented from curving by bearing against the collars *m*, *m*, of the rotatory guide rolls *l*, *l*. By the use of the guide rolls *l*, *l*, the plate is carried into and from the rolls without the aid of manual labour.

The patentees claim, "constructing and arranging in rolling machinery rotating side collars capable of adjustment, by which said collars lateral pressure is applied to the plates or bars during the rolling process; also guiding the plates or bars to and from the rolls of the rolling machinery by means of rotating guide rolls provided with adjustable collars or flanges."

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To JOHN HENRY JOHNSON, of *Lincoln's-inn-fields*, for improvements in fastenings suitable for portions of harness and other purposes,—being a communication.—[Dated 13th March, 1863.]

THIS invention relates to a simple and effective fastening, which is more particularly applicable to the hames of horse collars, but may be applied to various other purposes where a ready and safe means of securing and releasing is required.

As applied to the hames of a horse collar, one of the branches is provided with two holes made at right angles to each other, and formed one above the other, so that the two will partially intersect each other. Into the lower hole is fitted a bolt or pin, having a transverse notch cut in it at the part where it crosses the upper hole. This bolt or pin is connected with a ring or metal eye, through which the martingale is passed; the connection with the bolt or pin being such as will cause the bolt or pin to turn partially round in its socket or hole on turning the ring or metal eye to one side. On the opposite arm of the hame there is formed a spindle or stud, which fits accurately the upper hole above referred to, and a transverse notch is also formed in the under side of this stud, corresponding to the before-mentioned notch in the bolt or pin. In order to unite or secure the hames, the bolt or pin must be first turned partially round, so as to bring its notch in the line of the upper hole, when the stud can be readily inserted. The pin is now returned to its original position by bringing the ring or metal eye down again into a vertical position, whereupon the solid portion of the pin will enter the notch in the stud or spindle, and lock it effectually in its place. The pressure of the martingale in the ring or metal eye prevents it from being turned sufficiently to release the hames; consequently the accidental opening of the hames is avoided. In order to release them from the collar, the martingale must be first disconnected, when the ring is free to turn the required extent for the opening of the fastening.

In Plate XII., fig. 1 represents an elevation of a pair of hames provided with the improved fastening; fig. 2 is a longitudinal section of the fastening when released or open; and fig. 3 is a transverse section of the fastening taken along the swivel bolt or pin.

*a*, is a notched swivel bolt or pin, which is passed through the lower hole, and is formed with a screw thread at one end, upon which is screwed the nut *b*; a bead *c*, being formed on the other end of the pin, which may be countersunk if desired, into the eyes *d*, of the ring or swivel *e*. The nut is tightened up, so that the pin *a*, will turn with the ring or swivel *e*. *f*, is the spindle or notched pin, forming part of the opposite half of the hames; it is notched at *g*, and made to enter the hole *h*, as is clearly shown in the view where the parts are locked together in fig. 2.

The patentee claims "the peculiar construction of fastening as described, and its application to the hames of horse collars and other purposes as described."

*To JOSEPH TANGYE, of Birmingham, for improvements in portable hydraulic punching machines.*—[Dated 14th March, 1863.]

IN Plate XII., fig. 1 represents a front elevation of a portable hydraulic punching machine constructed according to this invention; and fig. 2 is a vertical section of the same; the parts of the machine being in the positions which they respectively assume when the punch has been raised from the the lower die.

*a*, is the hydraulic cylinder of the machine, in which the ram *b*, works; *c*, is the punch, secured to the ram by a screw pin *d*. The ram *b*, is made to work water-tight in the cylinder *a*, by means of a cupped leather packing *h*, on its top; the packing being fastened in its place by the screw *i*, and disc *k*. The cylinder *a*, is made by boring out the body *e*, which has a nearly semicircular figure laterally, so as to form a strong curved bracket for carrying the fixed die or punching tool *f*. Between the bottom of the cylinder *a*, and the upper side of the tool *f*, an opening or gap *g*, is made, to permit of the introduction of the plates or sheets to be punched. On the top of the cylinder *a*, the reservoir *l*, is fixed. The reservoir is closed by a cover *l'*. The junction of the reservoir with the cylinder is made water-tight by a cupped leather packing similar to that on the top of the ram *b*. An opening is bored in the axis of the lower part of the reservoir *l*, and into the opening the pump *m*, is screwed, as represented.

The construction and action of the pump *m*, are as follows:—A passage is bored out in the pump *m*, from end to end, and in the bottom part thereof the plug *n*, is fitted, the conical end of which plug bears on the seat *n'*, being kept thereon by the helical spring *n''*. The top of the plug *n*, is provided with a cupped packing, fixed in its place by the hollow set screw *n'''*, to prevent the escape of water between the plug and the opening in the pump. In the axis of the plug *n*, is the exit valve *o*, kept to its seat by the small helical spring *o'*. A perforated disc held against the bottom of the pump by the helical spring *o''*, supports the spring *o'*, of the valve *o*. *p*, is the plunger of the pump, the upper end of which works in the cover *l'*, of the reservoir *l*. In the axis of the lower part of the plunger *p*, the inlet valve *q*, is situated; the valve *q*, being kept



on its seat by the helical spring  $q^2$ , the upper part of which is fastened to the plunger by a pin passed across it. The pump takes in water through the hole  $r$ , opening into the reservoir  $l$ , and situated at about the middle of the liquid: the machine can be worked in any position. The entrances to the exit and inlet valves  $o$ ,  $q$ , are provided with discs of wire gauze, thus preventing injury to the seats of the valves by dirt. The pump is actuated by the hand lever  $s$ , on one end of the shaft  $t$ . The end of this shaft, situated in the reservoir  $l$ , has a tongue lever or cam  $u$ , on which it works in an opening in the plunger  $p$ . By the motion of the hand lever  $s$ , the plunger  $p$ , is made to rise and fall, and water is forced from the reservoir  $l$ , through the valves  $q$ , and  $o$ , into the cylinder  $a$ . The ram  $b$ , and punch  $c$ , carried by it, are thereby made to descend, and the punch punches a hole in the sheet or plate situated on the fixed die  $f$ . The descending motion of the hand lever  $s$ , is limited by the stop pin  $v$ , on the side of the reservoir  $l$ .

A hole having been punched in the plate or sheet, the ram  $b$ , is raised in the following manner:—The hand lever  $s$ , is capable of sliding on its shaft from the reservoir  $l$ , so that on descending it shall escape the stop pin  $v$ . The hand lever  $s$ , having been thus moved, is depressed below the stop pin  $v$ ; the plunger  $p$ , is thereby made to descend, and the inlet valve  $q$ , at its bottom, brought into contact with the set screw  $n^2$ , on the top of the plug  $n$ . The plug  $n$ , is thus forced from its seat, and the water in the cylinder  $a$  permitted to return through the waterway  $w$ , in the side of the pump  $m$ , to the reservoir  $l$ . The pressure on the ram  $b$ , being thus removed, the ram is raised into the position represented in fig. 2, by the cam  $x$ . The cam  $x$ , is situated on the end of the axle  $y$ , worked by the lever  $z$ . This cam  $x$ , is so shaped, that when it is turned into the lowest position, it does not impede the descending motion of the ram; but when in this last position, the cam, by giving a semi-rotation to it, can be made to raise the ram, as represented in fig. 2. In order to regulate the length of the stroke of the ram, and prevent any strain on the body of the machine after the required stroke has been obtained, a small metal rod is attached to the head of the exit valve  $o$ , the rod passing through the axis of the screw  $i$ . The rod 2, is made into a screw, and upon the screwed rod the lock nuts 3, work. These nuts 3, are so adjusted on the rod 2, that the distance between them and the bottom of the screw  $i$ , is equal to the length of the stroke which the ram is required to make. By this arrangement, when the ram  $b$ , has given the required stroke, the bottom of the screw  $i$ , strikes against the nuts 3; the exit valve  $o$ , is thereby forced from its seat, and the further action of the pump upon the ram is prevented.

The patentee claims, "Firstly,—arranging or combining the parts of portable hydraulic punching machines, essentially in the manner described. Secondly,—the improvement in raising the rams of portable hydraulic punching machines, described; that is, by means of a cam worked by a lever, made to engage with a shoulder or recess in the ram; the said cam, on a partial rotation being given to it, permitting of the descent of the said ram."

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To WILLIAM TASKER, the younger, of *Waterloo Iron Works, near Andover*, for improvements in the construction of harrows.—[Dated 9th January, 1863.]

THIS invention relates to a peculiar construction and arrangement of the frame of harrows.

In Plate XII., fig. 1 represents a perspective plan of the improved harrow, having the truss bars disposed at right angles to the lateral surfaces of the beams; fig. 2 shows the truss bars disposed parallel to each other, without regard to the zig-zag form of the beams to which they are secured. *a, a*, are the ordinary zig-zag beams, trussed by means of a series of short intermediate truss bars *b, b*, which, in fig. 1, are disposed at right angles to the junction surfaces of the beams to which they are secured, and consequently form a diagonal or zig-zag system of bracing.

In fig. 2, *b, b*, are the truss bars; *c*, are eyes formed on one end at any required angle; a screwed stem or bolt *d*, being formed on the opposite end, also at any required angle, or straight. In attaching these truss bars, the part *d*, is passed through the beam of the harrow and through the eye *c*, on the contiguous end of the next truss bar; a nut *a\**, is then screwed on to the end of the part *d*, which tightens up the two truss bars against the beam. Each end of the bar *b*, may be provided with an eye or foot at right angles to the bar, being intended to be used in the arrangement shown at fig. 1; but, if required for the arrangement fig. 2, the feet or eyes will be disposed at the proper angle to suit that of the beams. These bars are secured by a separate bolt passing through the eye of one bar, then through the beam, and then through the eye of the contiguous truss bar; or they may be bolted separately to the beams; or the two ends of the truss bar may be screwed, and have a shoulder joined thereon, the screwed parts passing only through the beam, and tightened up by nuts *c, c*, as in fig. 1, without being connected in any way with the contiguous truss bars.

The patentee claims, "First,—the general construction and arrangement of the frames of harrows, as described. Second,—the arranging of the truss bars of the frames of harrows diagonally at right angles to the zig-zag surfaces of the harrows, substantially as described, and illustrated by fig. 1. Third,—the peculiar mode of connecting and attaching the truss bars of harrows with and to the beams thereof, as described."

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To EDWARD PAINE, of *Liverpool*, for improved apparatus for facilitating the cleaning of vessels' bottoms while afloat.—[Dated 28th February, 1863.]

THIS invention relates to a simple apparatus for facilitating the cleaning of the bottoms of navigable vessels when afloat in harbour or at sea, consisting of an oval, compressed, egg-ended, or other suitably-shaped hollow vessel, formed of iron or other suitable material, surrounded on the outside by a series of brooms or brushes made from bristles, cocoa-fibre, piassava, or other suitable material, cocoa, india-rubber, or other suitable matting, alone or in combination with brushes or brooms. The sides and ends are provided with suitable eyes, or other means, for connecting guy ropes thereto, in such a way that the eyes, or their mechanical

equivalent, will not come into immediate contact with the ship's sides or bottom when in use. One of these guy ropes is connected to the front, and another is attached to the rear end, and one to each side of the hollow vessel. The end guy ropes are connected to the side ropes by bridle ropes.

In Plate XI., fig. 1 is a longitudinal section of the shell of one of the improved hollow scrubbers, and fig. 2 is a transverse section of the same, seen with the brushes applied thereto; fig. 3 is an external view of another hollow scrubber, fitted with longitudinal scraping ribs, but which scraping ribs may be applied vertically when it is intended to work the scrubber fore and aft. Fig. 4 is a side elevation of a modification of the improved travelling creeper, fitted with a "live" sheeve, over which the broom rope travels; and fig. 5 is an end view of the same. Fig. 6 is a side elevation of another modification of the travelling creeper, and fig. 7 is an end view of the same: this last modification may be fitted with a "live" or "dead" sheeve. Fig. 8 is a side elevation, and fig. 9 is an end view, of another modification of a keel creeper, constructed with a score or groove in lieu of the live sheeve. Fig. 10 is a top view or plan of an antifriction guy or broom chain; fig. 11 is a plan of three antifriction rollers, which are to be connected together with ropes in lieu of iron links, as seen in fig. 10. Fig. 12 is a longitudinal elevation of the hull of a vessel, showing the mode of using the improved hollow floating scrubber.  $\Delta^1$ , is an oval hollow vessel, with slightly pointed ends, and which, for the sake of strength, is divided into several chambers by diaphragms  $b$ ;  $c$ , tubes which pass longitudinally and transversely through the body of the hollow scrubber float, for the purpose of passing therethrough a longitudinal and transverse rope with spliced eyes  $a, a$ , at each end, for securing the broom or guy ropes thereto;  $d$ , brush secured to the exterior of the float;  $e$ , (fig. 3) longitudinal scraping ribs, which may be used alone or in combination with the brushes, brooms, or mats.  $f$ , is the body of the keel creeper, which it is preferred to form hollow or of a light material, so as to press towards the keel of the vessel: it is constructed with two longitudinal flanges  $g$ , which extend up the side of the keel, and keep the creeper in position when on the keel.  $h$ , are transverse rollers, upon which the creeper travels over the keel;  $i$ , a live pulley, over which the broom or guy rope travels;  $k$ , the keel of the vessel;  $m$ , rings for attaching the hauling or guy ropes to the creeper;  $n$ , a sinking weight attached to the bottom, and for sinking the creeper, to enable it to be the more readily got on to the keel of the vessel, and which is secured to the creeper by an oblique pin  $p$ , which is attached to the broom or guy rope by a small line, and to which also is attached, in like manner, the sinking weight  $n$ . When it is desired to detach this weight, the creeper being in position under the keel of the vessel, the guy or broom rope is hauled upon on the side to which the bridles are secured, when they can be removed therefrom previous to commencing operations with the scrubber.  $r$ , the transverse guy or broom ropes;  $s$ , (fig. 12) the fore and aft guy or broom ropes;  $t$ , creeper guy ropes;  $u, u$ , (fig. 10) are antifriction rollers, revolving on their axes within bearings in a flat chain  $v$ , on each end of the rollers, which, in combination, form an antifriction chain, for working the scrubber, in lieu of an ordinary rope.  $u^1, u^1$ , (fig. 11) are rollers which are connected together at their axles by a rope extending over and under

their axles, and which are secured together by seizings, thereby forming a series of eyes in which the axles of the rollers revolve, and thus constituting an antifriction rope.

When the creeper is used in connection with the improved floating scrubber, it is attached to the four guy ropes *t*, by the rings *m*; and connected thereto is the weight *n*, to facilitate the sinking thereof. The broom or guy rope is then reeved on the side opposite to that on which it is intended at that time to operate; the creeper is then dropped down over the fore foot, or over the stern of the vessel, and hauled into position by means of the guy ropes *t*; the broom or guy rope *r*, is then parted, to withdraw the oblique pin *p*, and the sinking weight *n*, is detached from the creeper and hauled on board, to detach it from the guy or broom rope *r*. The scrubber float is then attached to the reeved guy rope, the fore and aft broom ropes or guys being carried forward and aft on the outside of the vessel, and clear of the rigging; the scrubber is then passed overboard, and operations are commenced.

The patentee claims, "the construction, use, and mode of operating the improved hollow floating scrubber in the manner and for the object hereinbefore described and set forth, or any mere modification of the same."

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*To WILLIAM HENRY BUCKLAND, of Barge-yard, City, for improvements in the mode of, and in the apparatus for, producing gas for illuminating and heating purposes; parts of which improvements are also applicable for increasing the illuminating and heating power of ordinary lighting gas.*—[Dated 5th March, 1863.]

THIS invention relates to an improved mode of combining or impregnating ordinary atmospheric air with such a quantity of volatile hydrocarbon as will render it a combustible and illuminating gas, which may be burned in any suitable burner for heating purposes, or in ordinary gas burners, in place of the ordinary carburetted hydrogen for lighting purposes.

The invention is also applicable for carburetting ordinary illuminating gas, and by that means increasing its lighting power. This is accomplished without causing the gas or air to pass through the liquid hydrocarbon, and without the use of a wick, but by causing a current of air or gas under a suitable pressure to pass through a vessel containing a porous mass or material, which is kept saturated with any suitable hydrocarbon.

In Plate XII., fig. 1 is a longitudinal vertical section of one form of carburetting apparatus. *a, a*, is a rectangular or other conveniently-shaped vessel, divided into two compartments by means of a false bottom *b*. The space beneath this false bottom *b*, is supplied through a hole *c*, with any suitable hydrocarbon, and the quantity contained in the compartment will be clearly seen on the graduated glass index tube *d*, at one end of the apparatus. The upper compartment of the vessel *a*, is what may be termed the carburetting chamber; it is provided with a series of vertical transverse partitions *e, e*, which are made of perforated metal, and are loosely covered with flannel, cotton, or other fabric, the lower ends of which pass down through slots in the false bottom *b*, and dip into the liquid hydrocarbon beneath. The bottom

of the upper compartment or carburetting chamber may also be loosely covered with cotton, wool, or other porous material. The air or gas to be carburetted will enter the vessel through the opening *f*, and by passing along to and fro against or in front of the saturated porous or textile fabric, will ultimately issue from the apparatus out of the aperture or exit pipe *g*. The carburetting chamber is surrounded by a jacket *h, h*, thereby leaving a space which may be supplied with either hot or cold water, if desired.

Fig. 2 represents, in vertical section, a modification of this apparatus. In this instance the false bottom *b, b*, and also the vertical partitions *e, e*, with the flannel or other textile fabric, are dispensed with, and in place thereof the vessel may be filled with sponge, wool, coke, charcoal, or other absorbent porous substance; in this instance the vessel is shown filled with sponge, which rests on the bottom, and is partially immersed in the liquid hydrocarbon. The gas or air enters at *f*, and is distributed throughout the vessel by means of an arrangement of perforated tubes *i, i, i*. As the gas or air percolates through the spongy or porous mass, it takes up a portion of the volatile hydrocarbon, and becomes carburetted, so that it will burn with a very bright flame.

The patentee claims, "carburetting air or gas by causing it to pass over the surface, or through woven fabrics or fibrous or spongy substances which have the property of sucking up and exposing the liquid hydrocarbon in a finely-divided state. Second,—the apparatus described, whereby the desired result is or can be obtained."

*To WILLIAM WEST, of Saint Blazey, Cornwall, for improvements in valves.*  
[Dated 14th March, 1863.]

THIS invention consists in simplifying the construction and form of valves, buckets, or clacks. In Plate XII., fig. 1 is a half elevation and half vertical section of the improved valve, applied to an air pump bucket *D*, placed within a pump barrel *H*; and fig. 2 is an elevation, and fig. 3 a portion of a horizontal section, of a modification of the invention. *a*, is a groove formed in the outer part of the seating *j*, which in the present case has a slightly conical shape. The groove is made to run spirally, from the base to the apex of the seating; its form will depend upon the description of band which it is designed to carry. At the bottom of the groove holes or slots *b*, are made, communicating with the interior of the seating. The form and material of the seating may be varied as circumstances suggest. *c*, is an India-rubber or other elastic band within the groove of the valve seating, and shown partly in elevation and partly in section; it is composed of one continuous piece, though independent grooves may be made to surround spirally the seating; in this case, however, there would still be only one band for each spiral groove. The band is fixed at its extremities to the seating in such manner as best suited either to renew it or to facilitate the regulation of its pressure on the seating. The form of the band is arbitrary; in the present example it is shown circular. In order occasionally to strengthen and give a certain amount of rigidity, especially laterally, to the elastic band, a metallic wire may be made to

run in a manner more or less rapidly spiral through the centre of the band.

In the modification, figs. 2 and 3, instead of a spiral band, a series of elastic cords, marked *f*, may surround the seating in vertical grooves, and be secured at either end of the valve by rings *g*, or in any manner best calculated to ensure their easy adjustment. In order to exemplify the working of the valve, it is shown, in fig. 1, in connection with an air-pump bucket, marked *d*. It will be perceived that, when the bucket *d*, is being raised by means of the rod *e*, the band *c*, by the pressure of the atmosphere, closes all ingress to the bucket through the perforations *b*, in the grooves, and this is performed in a manner far more effectively than by any other valvular means hitherto in use; for the pliant nature of the elastic band, and its uniform pressure, ensure the absolute prevention of all communication between the interior and the exterior of the bucket. On the other hand, in forcing the bucket downwards, the same pliability and uniformity of the band leave the perforations in the groove free for the amplest proposed egress of the liquid to be raised.

The patentee claims, "the application and use of a continuous elastic band, placed within a groove, and winding spirally about the exterior of a perforated valve-seating, as described."

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*To ROBERT MUSHET, of Coleford, Gloucestershire, for an improvement in the manufacture or treatment of pig or cast iron.*—[Dated 9th March, 1863.]

WHEN pig iron, or cast iron in a melted state, is subjected to the pneumatic process of refining or decarbonizing—that is, by forcing air through the melted pig or cast iron—it is converted into a species of steel or semi-steel or malleable iron; and when the metal operated upon is of good quality, and free, or nearly free, from sulphur and phosphorus, the steel, semi-steel, or malleable iron obtained possesses greater toughness and tenacity when cold than steel, semi-steel, or malleable iron prepared by other processes. The tough and tenacious steel, semi-steel, or malleable iron produced from pig iron or cast iron decarbonized by the pneumatic process, possesses the property of communicating to pig or cast iron, with which they are mixed and incorporated, great strength, so as to render the metal peculiarly fitted for castings where great strength is required. The same effect is produced, but in an inferior degree, when melted steel, or semi-steel, or melted malleable iron, prepared by processes other than the pneumatic process, is mixed and combined with melted pig or cast iron.

The invention consists in combining with pig iron, or cast iron, which it is intended shall be moulded into castings, a quantity of melted steel, semi-steel, or malleable iron obtained by refining or decarbonizing pig or cast iron by the pneumatic process, or melted steel, or semi-steel, or melted malleable iron, prepared by processes other than the pneumatic process, in order, by the admixture of the pig or cast iron with the melted steel, semi-steel, or malleable iron, to strengthen and improve the quality of the pig or cast iron, and thus to adapt it to purposes for which cast iron of great strength is required. The mixture of the pig or cast iron is effected with the steel or malleable iron when the pig iron or cast

iron, as well as the steel or malleable iron, are in a liquid state. The quantity added to a given weight of melted pig iron or cast iron may be varied at pleasure, but in practice it is found that from three to fifteen pounds of the melted steel, semi-steel, or malleable iron, mixed with every 100 lbs. of melted pig iron or cast iron, afford excellent results. It is preferred to obtain the steel, semi-steel, or malleable iron employed in this process from hematite pig iron of Cumberland or Lancashire, or from spathose pig iron smelted from sparry ores or carbonates of iron, or from charcoal pig iron; but other pig irons, free, or nearly free, from sulphur or phosphorus, may be decarbonised or refined by the pneumatic process, in order to obtain the steel, or semi-steel, or malleable iron employed in this process. The pig or cast iron used is of the kind termed foundry iron or melting pig iron; but grey forge pig iron may also be advantageously mixed and combined with the steel, semi-steel, or malleable iron.

To mix these metals, take five tons of melted pig or cast iron in a large foundry ladle, and bring the ladle under the orifice or tapping hole or spout of the furnace wherein the steel, semi-steel, or malleable iron has been prepared by refining or decarbonizing pig or cast iron by the pneumatic process, and then run from about 300 to about 1500 lbs. of the steel, semi-steel, or malleable iron into the melted pig or cast iron contained in the ladle; then stir up the mixture with a rod or paddle of iron or steel, and proceed to cast or mould the mixture or compound in the ordinary manner practised by iron foundries. Melted steel or semi-steel, or melted malleable iron prepared by processes other than the pneumatic process, may be employed to mix with melted cast iron, but it is preferred to employ melted steel, semi-steel, or malleable iron prepared by the pneumatic process, as cheaper and more efficacious than steel, semi-steel, or malleable iron otherwise prepared.

The patentee claims, "mixing and combining with melted pig or cast iron, which it is intended to form into castings, a quantity of melted steel, semi-steel, or malleable iron, which said melted steel, semi-steel, or malleable iron has been obtained by refining or decarbonizing melted pig or cast iron by the pneumatic process, or melted steel, semi-steel, or melted malleable iron prepared by processes other than the pneumatic, in order, by this admixture and combination, to strengthen and improve the quality of the said pig iron or cast iron."

*To GEORGES DE LAIRE, of Paris, for improvements in the manufacture of brown coloring matters,—being partly a communication.*—[Dated 17th March, 1863.]

IN producing a brown coloring matter according to this invention, aniline, violet, or blue dye is taken, and treated with a salt of aniline. The salt which is found the most suitable is the hydrochlorate. The following is a convenient way in which to conduct the process:—Take 4 parts of anhydrous hydrochlorate of aniline, and 1 part of dry aniline, violet, or blue dye, which add to the hydrochlorate as soon as it has become fused. When the aniline dye has entirely dissolved, the temperature of the mixture is rapidly raised to the boiling point of the hydrochlorate of aniline, about 240° cent. The mass is maintained at this temperature until its color, which seems at first to undergo no alteration,

changes suddenly to brown. The operation lasts one or two hours, and may be regarded as complete when yellow vapours are observed to condense on the sides of the apparatus: at the same time a strong and altogether characteristic smell of garlic is perceptible. The brown color thus obtained is soluble in water, alcohol, and acids, and may be employed at once in dyeing, and without any previous treatment. It may also be purified by precipitating it from its aqueous solution by common salt. In general, sufficiently concentrated saline solutions or alkaline solutions precipitate the brown color from its solutions. In place of employing aniline dye already formed, the material for producing the dye may be substituted, as, for example, the arseniate of aniline (which heated by itself yields aniline red), and may be treated with the hydrochlorate of aniline, and the brown dye will thus be produced:

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*To WILLIAM EDWARD NEWTON, of 66, Chancery-lane, for an improved process for producing yellow coloring matters, and other colors which may be derived therefrom,—being a communication.*—[Dated 30th March, 1863.]

THIS invention consists in a novel process for obtaining from naphthaline a yellow dye, which may be used either alone for dyeing yarns or threads and piece goods, or may be treated with suitable chemical re-agents for varying its hue as desired.

The following is the mode of carrying out the improved process:—Take one hundred kilogrammes of naphthaline, and boil the same for a few hours in an acid solution, composed of two hundred kilogrammes of water, and twenty kilogrammes of nitric acid, 34° Beaumé. The naphthaline must be kept well stirred whilst dissolving in the boiling water and acid, and the agitation must be maintained until the mixture has become cold. Next draw off the mother liquor, and the naphthaline will then present the appearance of brown crystals. These crystals are now to be well washed in cold water, to remove the acid.

In order to obtain a yellow solution of coloring matter, the crystalline product is to be treated with boiling water, to which is added five kilogrammes of liquid ammonia. The solution thus obtained is to be filtered, and subsequently evaporated to a concentrated state. The concentrated solution must in like manner be filtered, and, when cold, it will be ready for use.

The patentee claims, "treating naphthaline in the manner and for the purpose above described."

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## Scientific Notices.

### INSTITUTION OF CIVIL ENGINEERS.

10th November, 1863.

JOHN HAWKSHAW, Esq., PRESIDENT, IN THE CHAIR.

The paper read was, "*Description of lighthouses lately erected in the Red Sea*," by Mr. W. PARKES, M. Inst. C.E.

HAVING been instructed by the Board of Trade to make the necessary preliminary surveys for establishing lights to facilitate the navigation of the northern portion of the Red Sea, the author recommended three sites,—1. Zafarana Point on the Egyptian shore, 50 miles from Suez; 2. the Ushruffee reef, on the western side of the navigable channel of the Straits of Jubal, 150 miles from Suez; and, 3. the Dædalus reef, in the centre of the Red Sea, 350 miles from Suez, and 180 miles from the entrance of the Gulf of Suez. These sites having been approved by the Egyptian Government, by the Board of Trade, and by the Directors of the Peninsular and Oriental Steam Packet Company, the immediate execution of the works was authorised, upon designs submitted by the author.

Zafarana Point being on the mainland, it was considered most advantageous to construct a tower and lightkeepers' dwellings of rubble stone, and to employ native labour entirely, under the direction of H. E. Linant Bey, the chief engineer of the Public Works' department of the Egyptian Government. The design presented no feature calling for special remark, and the works had been carried out in a very satisfactory manner. The light was a fixed dioptric of the first order, visible, over five-eighths of a circle, at a distance of 14 miles. It was first exhibited on the 1st January, 1862.

The main features of the other sites were then described. The Ushruffee was a coral reef, of which the sides sloped irregularly from the level of a few inches under low water to a depth of from 8 to 10 fathoms, no part being above the water, and there being very little sand, even in the cavities of the coral. The Dædalus reef was a submerged island, with a flat top of an oval form, 1200 yards in length and 450 yards in breadth, the sides being generally vertical, or in some places even overhanging. The actual surface of the coral was about 6 inches under low water; but there was a small shifting bank of sand near the south-east end, which was dry at low water, and sometimes also to a small extent at high water. The range of tide was about 2 feet at springs.

The peculiar conditions which had to be considered, in designing the proposed constructions, were—First, the force of the sea would be completely broken at some distance within the edge of the reef. Secondly, the structure would have to be built upon the surface of the reef, and not be sunk into it, as no additional security could be thus obtained, while the advantage of the natural platform would be lost. Thirdly, in the absence of any definite experience as to the actual

weight which the reefs would bear without being crushed, it was desirable to keep the weight per superficial foot of foundation as low as possible. Fourthly, the buildings had to be designed so as to mitigate the intense summer heat. And fifthly, in the case of the *Dædalus*, as the materials would have to be brought from Suez, and as there was no anchorage, it was necessary that a steamer should be employed capable of keeping close to the reef in any wind, and of providing quarters for the workmen and storage room for the materials, until a proper *dépôt* and habitation could be formed on the reef itself. These requirements rendered it essential that the materials should be small in bulk, that the several parts should be light and easily handled, and that the mode of putting them together should be as simple as possible.

It appeared to the author that these conditions would be best attained by adopting a structure of wrought-iron supported on teak piles, resting on, and the feet bedded in, a layer of concrete, so as to distribute the weight, the surface of the concrete being a little above the level of high water; and that, by filling in the wrought-iron framework with strong corrugated iron, so as to form a series of rooms one above the other, as a central column, with verandahs or galleries around each room, likewise partially enclosed, a portion at least of the sun's rays would be prevented from falling on the walls of the rooms, whilst there would be a free admission of air.

As the *Dædalus* light had only to guard against the dangers of the reef on which it was placed, it was not necessary that that structure should exceed the limited height that would allow of four tiers of rooms, and of accommodation for the lighting arrangements. These together brought the light to an elevation of 62 feet above the mean level of the sea. As the *Ushruffee* light had to lead vessels past dangers 12 or 14 miles distant, a more powerful light, at a greater elevation, was required. The height fixed upon was 125 feet above the mean level of the sea. The framework was of the same description in both cases, but in the latter case there were eleven tiers, whereas in the *Dædalus* there were only four tiers. Details were then given of the *Ushruffee* structure, as being the larger of the two. It was stated that this structure was supported upon eighteen piles, each 18 feet long and 18 inches diameter, arranged in two concentric circles. The inner circle consisted of six piles, and was 15 feet in diameter, while the outer circle was formed of six pairs of piles (the piles of each pair being 6 feet apart), 37 feet diameter at the top, and the feet spread outwards at a batter of 1 in 12. The feet of the piles rested upon the natural surface, and there were shoulders on each side of the piles resting on sleepers of teak, bedded on the concrete 2 to 3 feet above the surface of the coral. The heads of the piles passed through circular wrought-iron collars, to which they were accurately fitted, and any loosening by the shrinkage of the timber was provided for by fitting a number of wedges of green-heart timber into corresponding grooves in the pile heads, in which they could be driven down when slack. A direct bearing surface was also given by iron screws 2 inches diameter, which passed through each collar, and entered 2 inches into the wood. The collars had projecting arms to which the bottom framing was rivetted. The

superstructure consisted of a repetition of three main parts, which might be called respectively standards, cills, and radiators. In each tier there were twenty-four standards, arranged in two concentric circles, and these were connected at the top and bottom by cills, thus forming two twelve-sided polygons, the corresponding angles of which were connected by the radiators. With the exception of a few parts near the bottom, no separate piece exceeded 4 cwt. in weight. The floors of the rooms were composed of cast-iron plates covered with concrete, and from the lowest floor there was suspended a hemispherical water tank, capable of holding 1500 gallons. The floors of the galleries were formed of open cast-iron gratings. The whole of the ironwork of the structure was erected on Messrs. Forester and Co.'s premises at Liverpool, with the view of attaining the accurate fitting of the parts, and of testing its strength. While at its full height—with the exception of the piles at the bottom and the lantern at the top, but with the joints merely bolted together—it was exposed, in September and October, 1860, to two gales of wind, of the registered force, respectively, of 20·5 lbs. and 24·3 lbs. per square foot. There was no appearance of any straining of the joints, and a careful examination failed to discover any swaying movement at the top, though there was a sensible vibration. Since its erection on the reef it had been subjected to two severe gales, in June, 1862, and in January, 1863, with similar results; for although the top of the building had vibrated, there were no symptoms of straining having occurred.

The general principles of the construction of the *Dædalus* lighthouse were the same as those of the *Ushruffee*, with such modifications as its smaller size demanded: thus there were only twelve, instead of eighteen piles, and the dimensions of the parts of the framework were the same as for the upper tiers of the *Ushruffee*. The building was stated to be very stiff, scarcely any vibration being perceptible under a strong breeze.

The lanterns were of the same construction for the three lighthouses. Those for the *Ushruffee* and the *Zafarana*, being for first-order lights, were identical in every respect. That for the *Dædalus*, being for a second-order light, was of reduced size. In construction they were similar to those generally manufactured for the Trinity Corporation, but with special arrangements for mitigating the powerful effects of the sun. At the suggestion of Professor Faraday, a wind-guard was substituted for the ordinary revolving vane and cowl. The lanterns and light apparatus were furnished by Messrs. Wilkins and Co.; the optical portion having been manufactured by Messrs. Chance, Brothers, whose improvements in lighthouse illuminations deserved special notice. The *Zafarana* and the *Dædalus* were fixed lights, while the *Ushruffee* had a revolving light frame.

The whole of the materials of the two iron lighthouses, and of the three lanterns and light apparatus, were, with some trifling exceptions, despatched from Liverpool within ten months from the date of the author receiving instructions to proceed to survey the sites, at a distance of nearly 3000 miles from Great Britain.

As the structures were designed with a special view to the peculiar circumstances of the sites upon which they were to be erected, it was considered desirable to give some account of the operation of erec-

tion. The Peninsular and Oriental Steam Packet Company granted, gratuitously, the services of the "Union," a screw steamer of 300 tons and 60-horse power, the Egyptian Government paying for all wages, stores, and coal. The materials arrived at Alexandria on the 12th of November, 1860, but it was not until the 20th of December following that they were all received at Suez, and placed on board the "Union," which then sailed for the Ushruffee reef. The expedition, thus commenced, was unfortunately not successful. The causes of the failure were given at length in the paper, but it would be sufficient to state the results of the season's labour, which lasted three months. The piles were erected on the reef, and their heads were connected by the bottom iron frame. The whole of the iron work was landed, and laid out in order upon one of the neighbouring islands. This was not originally intended, as the plan decided upon was to moor the ship as near as possible to the reef during the progress of the works, and to land and sort the materials upon the concrete base of the lighthouse itself. After a full inquiry into the circumstances which had led to this failure, the author was instructed to make arrangements for a new expedition, and he readily assented to the suggestion that he should remain on the spot until the operations, as to which difficulty had been anticipated, were completed. The permanent superintendence was intrusted to the late Mr. C. W. Scott (Assoc. Inst. C.E.), Captain W. Kirtton being in command of the "Union." As the materials had been landed on the Ushruffee Island, it was determined to form a land establishment for the working party there, rather than to quarter the men on board. This left the steamer free to carry a working party to the Dædalus, without interfering with the operations on the Ushruffee. The staff was re-organised, and the list of plant and of materials revised; but, owing to several causes, the operations were not resumed on the Ushruffee until the 8th November, 1861. The first step was to form the shore establishment. This occupied three weeks, owing to the want of skill of the native carpenters in getting the huts ready for occupation. During this time, however, some progress had been made at the lighthouse. The caisson of iron plates to enclose the concrete base had been set up, and about 200 tons of gravel had been placed upon the reef, where it was exposed to a wash sufficient to remove some of the clayey particles. The process of depositing the concrete was then commenced, the plan adopted being to deposit it upon sheets of tarpaulin, which sunk with the weight, and protected the soft material from the action of the water, until a mass of several tons was collected. When the whole space was covered in this way up to above low-water mark, the remainder was deposited, as the state of the tide allowed, until the whole height of 5 feet from the surface of the coral was complete. The first half of the concrete was formed of six measures of gravel to one of Portland cement, mixed in the lighters moored alongside the caisson. The second half was formed of lime, puzzuolano, and broken stone, in the manner usually practised in the country. The latter was mixed dry at Suez, and was wetted on being deposited.

When the success of the process of depositing the concrete was well assured, the author turned his attention to the Dædalus, which was reached on the 26th of December. A site for the lighthouse was chosen near a small sandbank of triturated coral, as it was determined

to use the sand for the concrete, and as it was also convenient for beaching boats, &c. The surface of this reef was very irregular, there being numerous hollow places, varying from 1 foot 6 inches to 2 feet in depth. A four-legged shears was set up on the intended site, and a platform fixed upon it at the level of the under-side of the pile collars. Upon this platform were bolted together the plates, forming the polygon, to complete the inner circle of piles. The six piles were then successively raised on end, and the collars were bolted to the polygon. When the six piles were fixed, the original stage was removed, and a new one was formed, to receive in a similar manner the outer polygon. This having been fixed in place, and the two polygons connected by the radiators, the outer piles were raised. The caisson plates were then set up, being first bolted together, and then partially rivetted. The whole of these operations occupied seven days and a quarter, the staff employed, consisting of four workmen, and parties of from six to eight men of the crew. The lighter "Ushruffee," was then moored upon the reef, and the steamer proceeded to whence it returned with 50 tons of cement and twenty Arab labourers, under a native foreman, for depositing the concrete, and having a second lighter in tow. The concrete here used consisted of  $3\frac{1}{2}$  measures of coral sand to 1 measure of cement. The first operation was to fill up the holes between the coral lumps with coal bags filled with concrete, so as to make an even surface to lay the tarpaulins upon. The deposit was then carried on in the same manner as at the Ushruffee. The quantity of cement, above alluded to, was only sufficient to complete three-fourths of the required height of the block. This occupied just eight days, and then the author returned to Ushruffee, and finding five tiers of that lighthouse erected, and partly rivetted, he handed over the entire charge of both works to Mr. Scott, who shortly after proceeded with a party of four mechanics, two rivetters, four labourers, and ten Arabs, in all twenty, besides the crew, to the Dædalus. With these, in twenty-six days, the work being carried on only on twenty-one days, the whole framework was erected and rivetted together, two floors and the water-tank were completed, and the lower room was enclosed. Two mechanics and four seamen were then placed in the building, with provisions and water, to continue the work, and the "Union," with Mr. Scott and the remainder of the working party, returned to Ushruffee. Thus, in thirty-seven working days, the main portion of the building, now 57 feet in height, was so far finished as to be habitable for a party sufficient to complete the remaining details. Had the ship been of larger burthen, it was believed that these thirty-seven days might have been continuous, and that the whole would have been accomplished during an absence of about seven weeks from Suez. The author referred in terms of the highest praise to the manner in which what might be termed the nautical part of the undertaking had been carried out by Captain Kirton. Subsequently, the materials for the lantern and the lighting apparatus were deposited in the building, and afterwards one leading mechanic, two labourers, and five seamen completed the work between November, 1862, and the 1st of February, 1863, when the light was exhibited.

At the last mention of the Ushruffee the concrete base had been completed, and five out of eleven tiers of framing had been erected,

During the absence of Mr. Scott and his party at the *Dædalus*, a European boat's crew of six men was engaged in conveying the remainder of the materials to the reef, and in sorting them there. On the return of the working party, the erection was rapidly proceeded with, in the face of much difficulty, from almost constant high northerly winds. The time actually taken in erecting the skeleton framework, 106 feet in height, was two months, and the rivetting was completed within three months. The two succeeding months were occupied with the erection of the lantern and lighting apparatus, and completing the details of the building; and on the 1st of July, 1862, the light was first exhibited.

In connection with this undertaking the profession had to regret the loss of a very promising young member, Mr. C. W. Scott, who, towards the close of the operations, was attacked with symptoms, which developed the seeds of a disease of long standing, under which he succumbed, after an interval of five months.

With regard to the cost, a mere statement of the total amount expended upon the two lighthouses, £55,211 in all, would convey an erroneous impression, unless accompanied by an explanation. The cost of the whole as an engineering work, independently of the employment of the steamer, might be taken at £32,079, including all contingencies, supposing the reefs to have been within a boating distance, say one mile and a half, and half a mile from Suez. If the steamer had been equipped at Suez, and had been continuously employed, then, on this supposition, the cost might have been £42,082. The remaining expenditure, £13,029, was entirely exceptional, arising mainly from the steamer being equipped at Bombay.

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November 17th, 1863.

J. R. McCLEAN, Esq., VICE-PRESIDENT, IN THE CHAIR.

The paper read was, "*On the duty of the Cornish pumping engines*, by Mr. W. MORSHEAD, jun.

It appeared from a tabular statement prepared by the proprietor of "*Lean's Engine Reporter*," for the years 1841 to 1860 inclusive, that the average duty of these engines had fallen off from 68 millions in 1844, to 52 millions in 1860, or 25 per cent.; also that less interest was now felt in the performance of these engines, as while fifty were reported in 1841, only fifteen were reported in 1858, and twenty-five in 1860. Although the nominal or reported duty showed this marked diminution, it was not asserted that there had been an actual falling off to the extent thus indicated,—for the duty paper did not take into account the quality of the coal, which was certainly inferior to that used twenty years ago; besides which, the present practice of sinking the engine shaft, for the whole or part of its depth, in an inclined direction upon the course of the lode, must have tended to increase the friction of the pit work, and the mines were also deeper than formerly. Nor was expansion of steam adopted to so great an extent now as it was some years ago: it was then carried further than was compatible with safety,

as was evidenced by the repeated breakages of the main rod, the piston rod, and the other principal parts of the engine. But after allowing for all these legitimate causes of the falling off of duty, it was thought that the average duty of the county was still at least ten millions below what it should be.

The author next examined the causes of this decline, and then discussed the means by which it might be remedied. The primary cause he believed to be, the indifference of the mine proprietors to the performances of the engines. So many accidents attended the use of high steam, cut off at an early part of the stroke, that economy of fuel came to be regarded as synonymous with repeated breakages; but it was quite possible to raise the duty considerably above the present average, without resorting to an undue rate of expansion. This might be accomplished by a more perfect and extended system of reporting the engines, and by a new form of duty paper, embracing the following additional items:—First, that the load upon the piston should be taken from an indicator diagram, and from the load thus ascertained, the duty should be computed; the difference between the load upon the piston and the weight of water actually lifted, that was the loss by the friction of the pit work, &c., being placed in a separate column. Secondly, that the part of the stroke at which the steam was cut off, as well as the vacuum obtained, should be stated opposite each engine. Thirdly, that a notice of the quality of the coal used, as far as it could be ascertained, should be added. And lastly, that the engines should be separated into two classes,—those which might reasonably be expected to give a good duty, and those which, from the time they had been at work, their small size, or other causes, could not fairly compete with the former. By taking the load upon the piston from an indicator diagram, a fair estimate of the work actually done by the engine could be formed; while by placing the difference between the load upon the piston and the weight of water actually lifted, in a separate column, encouragement was offered for improvement in the construction and fixing of the pit work.

At present, only about one-tenth of the engines at work in Devon and Cornwall appeared in the monthly reports. If mine proprietors would co-operate in supporting a good form of duty paper, there was little doubt but that there would be a rapid and marked improvement in the duty of the Cornish Engines.

## THE LONDON ASSOCIATION OF FOREMEN ENGINEERS.

6th November, 1863.

MR. JOHN IVES IN THE CHAIR.

The paper read was by Mr. OUBRIDGE, "*On a new method of casting guns hollow.*"

THE author remarked that the subject which he proposed to consider that evening was one upon which much had been already said and written. He believed, nevertheless, that it was not exhausted; for it was a fact that, as yet, no heavy gun had been produced which answered

all requirements. Brass guns had had their day, cast iron guns had been long used, were at one period almost totally condemned, but were now cropping up again, and much might be adduced in their favour. Wrought iron, in multifarious forms, had been employed in the manufacture of guns, each form having peculiar advantages; but the results, on the whole, were not satisfactory. Steel had also been introduced for the purpose; but in spite of its great cohesive strength, it had been found impossible hitherto to make from it good, sound, and serviceable guns of large calibre. Many practical difficulties stood in the way of its employment in this direction, although certainly some very successful efforts had been made to construct light and small pieces of ordnance of that material. Compound guns, composed of cast and wrought iron—the one encasing the other—had also been tried, with variable and uncertain effects; but as yet no absolute rule had been deduced for the guidance of those whose duty it was to manufacture heavy guns. Time, and the expenditure of much more of the public money, might effect this great desideratum; but it had not yet been achieved; and it was, therefore, the duty of practical and scientific men to endeavour to solve the problem “how best to manufacture heavy guns?” He (Mr. Oubridge) intended to contribute a few items to the mass of existing information on the subject; and he might state that such knowledge as he had to impart had been gained from his own experience and experiments in the iron foundry. It was required, in the production of large pieces of ordnance, that the material used should be made to offer the fullest possible resistance to the bursting strain to which it would eventually be exposed, and that the cohesive strength of that material should be completely maintained. Perhaps, before advancing his own views, he might be permitted to refer to the method of casting heavy guns, which had been largely practised during the unhappy contest which still raged in America. The name of Dahlgren would no doubt be familiar to his hearers in connection with the American civil war, and the guns which were known as “Dahlgrens” possessed some distinguishing features. They were cast hollow, the theory of their inventor being that it was desirable “to reduce the neutral axes of his gun as nearly as possible to the centre of the thickness of the metal of which it was formed.” This would be clearly seen to be the case from the diagram produced. If, on the contrary, the gun were cast solid, the cohesive power of the metal would be diminished as it approached the centre. By casting the gun hollow, this deteriorating process would be lessened by the pressure of the core in the mould. Dahlgren had evidently well considered the laws of cohesion and disintegration which governed these results. He had also adopted the plan of assisting the cooling and contracting, by pouring a stream of cold air through a tube of iron inserted in the core barrel. In this he was perfectly right, for it ought to be understood that if the cooling process operated entirely from the outer portion of the casting, it was, to use a familiar illustration, like casting an iron ring upon a mandril—an operation which they all knew would be a senseless proceeding. This plan had, however, been persistently followed until the Armstrong gun was introduced. He (Mr. Oubridge), had, several years before, submitted to the Select Committee of the Board of Ordnance, a scheme for casting heavy guns



hollow, but the reply of that body was, as usual in such cases, unsatisfactory. At the same period an American gentleman made some attempts to accomplish, in this country, the same thing, but without success. For his purpose six cupolas were erected near to the Charlton Pier, on this side of the town of Woolwich, and the experiments there conducted were of a costly character. The theory was not the less a true one; the defect lay in its imperfect realisation.

There was no doubt in his own mind that homogeneity would be obtained to a far higher degree in large iron castings if they were made hollow in place of being solid. He had had an opportunity a few months back, indeed, of practically demonstrating the fact. A large hydraulic cylinder, requiring 17 tons of metal to cast it, had to be produced. It was to have a very small hole through the bottom end, where the iron would be 15 inches thick. He saw that the intense heat would inevitably melt the core barrel long before the metal composing the cylinder ceased to be fluid. He therefore assumed it to be a favourable opportunity for putting to the test his cherished theory. The casting was to be produced in the foundry of the Messrs. Simpson, at Pimlico, and Mr. Thompson, the manager for that firm, giving his consent, he determined to cool the core by means of an internal current of cold air. The plan of operation was very simple. A perforated tube was inserted in the core barrel, and then communicated, by means of a pipe and valve, with the blast. As soon as the mould was filled with metal, the valve was opened, and the cold air forced into the tube found an outlet through the perforations, whence it impinged upon the barrel: this latter was also perforated so as to allow of the escape of gases from the interior of the core. The result was a complete success, and the cylinder was as sound and homogeneous as could be desired. The cooling process had thus gone on from the centre, instead of the exterior of the casting. When the operation had, as he considered, lasted sufficiently long to prevent the metal remaining in a fluid state, he caused the blast valve to be shut, and in half an hour the core barrel was found to have melted in one place, leaving an aperture three inches in diameter. The blast was then again turned on, and in less than ten minutes the barrel became black. By this method, which was of the most easy application, it was possible to reduce the temperature of the interior of a casting to almost any extent, and in a very short space of time. He desired to throw his mite into the treasury of human knowledge. It was for others to put it out, if they chose, to interest. Perhaps those who might be called upon to produce heavy castings, whether for the purposes of war, or in fulfilment of the more hallowed behests of peace, would be induced to take up the hints which he had that night ventured to give. It was to be hoped that the practical founders of England, especially, would be permitted to exercise their own judgment as to the selection of the various irons best suited for partial castings, and that in the manner of producing those castings they would not be hampered by mere theorising or "paper engineers," of whom too many had crept into the noble profession of which he was a humble member. He had a reverence for art and science, and for its practical exemplars, but not even ordinary respect for those who pretended to be their disciples, but were nothing more than pretenders.

After the reading of Mr. Oubridge's paper, which was well illustrated by diagrams, a discussion ensued, and this was followed by a vote of thanks.

The absence of the President (Mr. Newton) from this meeting, we regret to learn, was due to an accident, by which his left arm was dislocated.

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## Scientific Adjudication.

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### VICE-CHANCELLORS' COURTS.

Nov. 19th and 20th, 1863.

(Before Vice-Chancellor SIR R. T. KINDERSLEY.)

FOXWELL v. WEBSTER.

THE plaintiff in this case, who had purchased, for £50, Judkins's patent for sewing machines, had filed no less than 134 bills against various parties, who he alleged were infringing his patent right, and that 77 defendants appeared on the present occasion upon four motions, having for their object, in substance, that the plaintiff might select one suit, carry it to a hearing, and determine the validity of his patent; and that in the meantime the other suits should be stayed, and the time for answering and producing documents enlarged. The bills, which were stated to be almost identical, varying, however, of course, in the name of the defendant and the applications made to each, stated that Charles Tiot Judkins, of Britannia Works, Manchester, was the first and true inventor of "improvements in machinery or apparatus for sewing or stitching," for which a patent was granted, dated the 16th of October, 1852. On the 13th of December, 1854, Judkins deposited the letters patent with the National and Provincial Banking Company, by way of equitable mortgage, and was made a bankrupt on the 14th of June, and assignees were appointed. By indenture, dated the 18th of May, 1859, the office of the National and Provincial Banking Company, and the assignees, assigned the patent to Daniel Foxwell (the plaintiff)—as it appeared on the motion—for £50, in the usual form. The petition, &c., in bankruptcy, and the assignment, were registered in the Patent-office, under the Act, and the plaintiff applied to file a disclaimer of alteration, and the fiat was granted on the 10th of March, 1862. The bill set out the disclaimer *in extenso*, with reference to the drawings annexed, claiming the improvement as a new invention as to the combination and arrangement of the various parts of machinery for sewing or stitching with the use of a needle and shuttle. It was stated that the invention was of great public utility, and had never, prior to the date of the patent, been known to or used by any person within this realm, except Charles Tiot Judkins, who, with the mortgagees, assignees, and plaintiff, had successively the sole and exclusive privilege to

use and vend the invention within the United Kingdom and the Channel Islands; and the plaintiff now claimed the sole use and privileges, and that it was a branch of his trade at Roger-street, Red-bank, Manchester. The bill then stated that the plaintiff had granted to William Frederick Thomas a license to make and vend "Judkins's sewing machines," and he (the plaintiff) had been paid by various persons for metal plates, £5 for each machine used before the 20th of June last, and £2 since, by way of royalty. The invention consists in a straight needle, which pierces the cloth, carrying through it the thread, which is passed through the eye of the needle, when it begins to return; the friction of the cloth causing the thread to bulge and form a loop, through which the shuttle carrying the second thread is passed at the instant the loop is formed, which is then drawn tight, and a fast stitch thus formed. A serrated plate also regulates the movements of the cloth, and by a proper combination of the working parts the whole movements are accurately arranged, so that a thousand stitches per minute can be formed. The plaintiff's alleged improvements would be unintelligible, except to an adept, without an annexed drawing; the chief desideratum alleged to be accomplished being the working in any desired direction, and not in a straight line only. The bill then stated that the plaintiff had invested a large capital in the sewing machines, the trade being highly remunerative. In November, 1862, the plaintiff brought an action against William Frederick Thomas, for an infringement, which, after six days' trial, ended in the discharge of the jury, as they could not agree, on the 12th of February, 1863. On the 16th of June the same action was again tried, and ended in a compromise for £4250. On the 11th of July, 1863, the plaintiff's solicitor sent the following letter to the defendants:—

"Sir,—Mr. D. Foxwell, of Manchester, having obtained a final verdict against Mr. W. F. Thomas, for infringement, establishing the validity of Judkins's patent of the 16th of October, 1852, for sewing machines, of which he is the proprietor, I am instructed by him to require the immediate payment to me of royalties on all machines having a needle and shuttle, or any of the principal movements secured by that patent, which have been made, used, or sold, in infringement of that patent (except those which have been or may be sold by Mr. W. F. Thomas, for which he has paid Mr. Foxwell); and as you have made, used, or sold a number of sewing machines, made by different persons, which infringe that patent, I require you, within three days from the receipt hereof, to make a true and correct return to me, stating the total number of all such machines, that I may know the amount of royalties, at the rate of £5 per machine, payable and recoverable against you. I may mention that, as Mr. William Thomas enforced payment of £10 royalty on two needle machines which infringed his patent of 1846, Mr. Foxwell feels that a royalty of £5 will be very reasonable. The costs of the litigation of Judkins's patent referred to has altogether been above £10,000, and as the Lord Chief Justice Erle, before whom the cause has been twice tried, certified as to the validity of the patent under the statute, Mr. Foxwell will be entitled to recover full costs, charges, and expenses, as between attorney and client, against defendants in all future actions on the patent."

Then followed a threat of proceedings in case of non-compliance, with offers of accommodation to those unable to pay, and of granting licences, &c. Then followed a series of charges as to infringement, &c.; and the bill prayed an account and payment of the proceeds of sewing machines sold, and for liquidated damage, £5 for each sewing machine, and delivery up of them to be broken up, and for an injunction and inspection, and for payment of the costs.

Interrogatories had been filed to this bill, and the next step would be that answers should be put in, and to save this vast expense and amount of litigation, it was, as they alleged, that certain of the defendants had agreed to move as above, for a consolidation of the proceedings, by compelling the plaintiff to select four bills out of the seventy-seven now in existence, the defendants to the other bills consenting to be bound by the result. An affidavit had been made by Messrs. Field, Roscoe, and Co., Messrs. Slee and Robinson, and Mr. Peacock, solicitors, as to the probable amount of costs if the answers were put in, and the suits went on, which were stated as detailed items, amounting in the whole to £134,000. An affidavit was also read, made by the plaintiff's solicitor, in which he stated that the plaintiff never intended to proceed to a hearing, but in some of the suits to proceed at law as to the validity of the patent.

Mr. Rolt, Mr. E. Kay, and Mr. H. Bagshawe appeared on the first motion, on behalf of nineteen defendants, and contended that the object of the plaintiff was evident. He never did intend to proceed with the suits, but by intimidation to put a stop to competition, without establishing his patent right. This he had ineffectually endeavoured to do three times, and the question was therefore now open. The fact of such a vast number of bills on one subject matter was not only unprecedented, but so vexatious and enormous an evil, that the Court, having in itself, as it always had, the power of trying the validity of the patent, or the discretionary power of directing an issue, could also, in its discretion, stay all proceedings in the majority of the suits until the question governing the whole was decided—that is, the validity of the patent. Discovery was here of no use, because that only went to the fact of infringement, and if there was no patent, there could be no infringement. The case was analogous to the case of ejectments, bills of peace, underwriters' suits, &c. The bill stated the patent to be valid, otherwise it would have been demurrable; but the fact was that it was not established at law, and therefore no injunction could be granted pending the trial of the right.

Mr. Osborne and Mr. C. R. Roupell appeared on another motion, the same in substance, except as to enlarging the time for answers, &c., for seven defendants, and argued that the cases were so identical that one could represent all, and the plaintiff having lain by and fostered the trade by the defendants, had then turned round upon them, which was a great hardship. These defendants had only bought the machines to use, not to sell, and had agreed to admit the plaintiff's right.

Mr. Freeling appeared for eleven other defendants on substantially the same motion, and stated that in this case 150 bills had recently been filed, and there was no precedent, except a case which occurred a long time ago, when a complaint was made of there being fifty bills filed in a patent case to Sir Peter Laurie, sitting at the Mansion-house, and, the

matter getting into the papers, the counsel went to Sir Peter Laurie, when the matter was compromised.

Mr. Osborne and Mr. Waller then moved, on behalf of forty-six other defendants, in the same terms, as to trying the question by one suit, but saying nothing about an issue. They employed the same solicitor, and two were makers of the machines, the others purchasers and users only. They had elected to try the question by the suit of "Foxwell v. Jones." This motion was quite distinct from the others. An affidavit was read by the solicitor, Mr. Edwin Stovel, of Fountain-street, Manchester, stating that in each suit the costs of the plaintiff already amounted to £50.

Mr. C. Locock Webb, for the plaintiff, read an affidavit of Mr. Wickens, his solicitor, stating that these proceedings were the result of a combination of an association called "The Makers', Dealers', and Users' of Sewing Machines Central Association," with a subscription of 5s. per month, which had passed resolutions to resist a monopoly, and obtain information as to patents, &c., the object being directly pointed at the plaintiff's patent. The affidavit went on to set out anonymous letters defying the plaintiff, and, suspecting that it came from a member of a committee, he wrote to him (Mr. Royle), but received no answer.

Mr. Freeling stated that his clients were not members of the association.

Mr. Waller said the association had the most legitimate object—namely, that of gaining information as to the state of this trade.

Mr. Glasse, Mr. C. Locock Webb, and Mr. Theodore Aston (of the common law bar) appeared for the plaintiff.

The Vice-Chancellor asked Mr. Glasse whether he would object to the dismissal of the motion without prejudice to any application after answer put in?

Mr. Glasse having answered in the affirmative,

His Honour said that the able and ingenious arguments he had heard on this batch of motions had failed in convincing him that in common justice they could be granted, having regard to the persons, and the position of circumstances under which they arose. According to the rules of law, if the plaintiff endeavoured to proceed against more than one defendant, the other would instantly say, "What have we to do with the others?" and insist upon not being joined with them; and they would succeed in that objection, the plaintiff having no right so to join them. It was said, why did not the plaintiff file a bill against a few? No doubt he would be too happy to do so, because, it had been said, that each bill cost him £50; but it was well known in cases of injunction, that a plaintiff could not slumber on his rights, but must come at once; and if he abstained, knowing that an infringement was taking place, he would lose his remedy, as the other defendants would repudiate any connexion with those who were sued. Therefore, assuming the plaintiff's patent good (as it must be assumed for this purpose), he had a right to proceed, insisting on its validity, and it might turn out that all the 134 defendants were separately infringing it. It was characterized as a gross oppression, but it was not so in the least. The fact of an association with a common fund was another question, which could not now be considered. Mr. Freeling

honestly threw that over entirely. It was also said to be an oppression on the public. His Honour agreed with the abstract proposition, that where there were 134 suits or actions by one plaintiff, founded on the same right, the Court would willingly attend to have the matter tried at once, and so, *toties quoties*, would struggle to effect that object: but, only consistently with the plain rights of a plaintiff in this court. These motions were argued upon what the gentlemen who prepared them, probably never thought of; they were in truth saying, "Don't compel us to put in an answer." The last motion somewhat differed from the rest in terms, but not substantially. Suppose these motions granted, fifty-seven suits would still remain, and all those defendants might make similar applications, and the evil would still exist. It was said that the Court should now direct an issue; that was not the motion, and cases were cited to prove that, where justice required it, the trial of some question necessary to give the plaintiff relief would be directed; and no doubt that Court had, over and over again, on cases for injunctions and receivers on an interlocutory application, so directed—not only in one, but in a greater number of suits. But here it was said the Court would do so, not merely on motion by the plaintiff, but by the defendants—the gist being that they should not put in an answer. There were two heads—validity and infringement; and it was said, if the plaintiff's patent was bad, what did it matter whether there was an infringement or not? The defendants had done nothing which he had a right to complain of, whether the patent was bad by reason of the want of novelty or utility, &c. The plaintiff did not want to proceed with the suits until the validity of the patent was decided, but he did want answers to show whether he would be entitled to a decree. The rule with regard to answers was, that the defendant must fully answer all the pertinent and relevant interrogatories, and was only absolved from putting in an unnecessary and burdensome account; and that was all that was decided in "*Delarue v. Dickenson*," the nearest in semblance to this case. It was not sufficient simply to deny infringement; such an answer would be excepted to. But this motion, was even a stronger case than that; it was not to be compelled to put in an answer at all. He (the Vice-Chancellor) was at a loss to understand how the putting in an answer could affect or prejudice any one defendant. Assuming nothing as to the validity of the patent, which was a question that might have to be decided here hereafter, the elementary right of the plaintiff was to the discovery from the defendants of those matters in respect of which he might get a decree at the hearing, or tending that way; and therefore what was asked, although in itself reasonable, was at the expense of the rights of the plaintiff, which this Court would not take from him. The mistake was to apply in this mode, at this stage of the cause; and, therefore, in dismissing these motions with costs, there must be a direction that the order should be without prejudice to any proceeding which the defendants, or any of them, might be advised to take after answer. It had been admitted by one party that if the answers were put in, there would be no wish to consolidate—an avowal of the object of the motion.

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## COURT OF CHANCERY, LINCOLN'S-INN.

November 24th, 1863.

*(Before the Lord Chancellor.)*

FOXWELL v. BRADBURY.

THIS was an appeal from an order of Vice-Chancellor Kindersley, relating to the practice of the Court when a multiplicity of suits have been instituted by the same plaintiff. It appeared that the present plaintiff was the assignee of a patent for certain sewing machines, and had brought several actions at law to establish his right. He had also recently filed 150 bills in Chancery against as many persons who he alleged had infringed his patent. A motion was made by seventy-seven of the defendants to the Vice-Chancellor a few days back, that the proceedings in the different suits might be consolidated, and that the plaintiff might be compelled to try his right in one or a small number of suits, and that in the meantime the other suits might be stayed; the defendants to be bound by the decision in the suit or suits tried. The Vice-Chancellor refused the application, on the ground that the plaintiff was entitled to an answer from each defendant (all of whom he charged with having infringed his patent), on which possibly he might be entitled to a decree. From this decision the present appeal was brought.

Mr. Rolt and Mr. Kay appeared for the appellants; Mr. Osborne, Mr. C. M. Roupell, Mr. Freeling, Mr. Waller, and Mr. Bagshawe for other defendants; Mr. Glasse, Mr. L. Webb, and Mr. T. Aston for the plaintiff.

The Lord Chancellor directed the motion to stand over until the first day of the sittings after term, to give the plaintiff an opportunity of filing an affidavit setting forth specifically each class of infringement of his patent, and the combinations of parts of the machine claimed as new and used by any of the defendants, for the purpose, if possible, of consolidating the suits in classes.

Nov. 20th and 25th.

*Before the Lord Chancellor.*

SPENCER v. JACK.

THIS was an appeal from an order of the Master of the Rolls. The plaintiff was an engineer at Newcastle, and in July, 1860, he took out a patent for an improved method of condensing steam for working steam engines on board ships. It appeared from the specification, that the plaintiff claimed, as his invention, a new combination of well-known matters—namely, surface and jet condensers of steam—which produced new and valuable results. The bill was filed to restrain an alleged infringement of the patent by the defendant's engineers at Liverpool, and, upon the application to the Master of the Rolls for an injunction, his Honor directed issues at law to try whether the patent of the plaintiff was a new and useful invention, whether it had been sufficiently described in the specification, and whether there had been

any infringement of it by the defendant. The jury found in favour of the plaintiff on all the issues, and an application for a new trial was made to the Master of the Rolls on the following grounds:—First, that there had been a misdirection of the Lord Chief Justice of the Common Pleas; second, that the verdict was against the evidence; third, that there had been a miscarriage; and fourth, that the defendant had been taken by surprise. The Master of the Rolls granted a new trial, and, upon appeal from that order to the Lords Justices, their Lordships suggested that the matter should be brought before the Lord Chancellor, which was accordingly done.

Mr. Baggallay and Mr. Rigby, with Mr. Streeton and Mr. Webster (of the Common Law Bar), were for the plaintiff appealing; Mr. Bovill (of the Common Law Bar), Mr. Selwyn, and Mr. Druce for the respondents.

The Lord Chancellor, in delivering judgment, said this was a case in which an issue as to the facts of the invention was directed to be tried in the Court of Common Pleas, the law being reserved. The Lord Chief Justice of the Common Pleas felt himself bound only to try the issue as to the facts, and to ask certain questions of the jury on which a verdict was found favorable to the patent, and the learned Judge did not express any dissatisfaction with the verdict.

His Honour the Master of the Rolls, in deciding on the law of the case as reserved, did not seem to take the verdict of the jury as the foundation of the inquiry. But, as there was every reason to believe that the jury had been put in full possession of the facts which they had to determine, and there was no apparent objection to their verdict, it must be accepted. And the effect of the verdict was, that the invention disclosed in the specification of the plaintiff was a substantial improvement on the pre-existing state of things.

Under these circumstances, the Lord Chancellor said, he was of opinion that the improvement of the plaintiff was the subject matter of a patent, and therefore that his claim to the patent in question was well founded. But on looking at the specification, it was clear that the invention was confined to the kind of condensers patented by him in 1857 and 1858, as the document all the way through was consistent with this interpretation alone. And as the particular kind of condensers referred to had not been used by the defendant, there was, therefore, no infringement.

The bill must thus be dismissed without costs, and the order of the Master of the Rolls must be reversed.

His Lordship added some strong reflections on the evident misconceptions of the case which had led to so enormous an outlay on proceedings that had issued in so fruitless a result.

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## Provisional Protections Granted.

[Cases in which a Full Specification has been deposited.]

2522. Henri Adrien Bonneville, of Paris, impd. apparatus for cleaning ships' hulls,—a communication.—*October 14th.*
2546. John Henry Johnson, of Lincoln's-inn-fields, impts. in washing machines,—a communication.—*October 17th.*
2663. William Edward Gedge, of Wellington-street, impd. system of permanent advertisement,—a communication.—*October 28th.*
2728. Joseph Tangye, of Birmingham, impts. in portable hydraulic shearing and rivetting machines.—*November 4th.*
2768. Jehiel Keeler Hoyt, of New York, impts. in revolving fire-arms,—a communication.
2779. George Haseltine, of Southampton-buildings, impd. machine for bending metallic pipes or spouts,—a communication.
- The above bear date November 7th.*

[Cases in which a Provisional Specification has been deposited.]

1491. William Williams Box, of Birmingham, impts. in fire bars for the boilers of locomotive and other engines, and for fire boxes and furnaces generally.—*June 15th.*
1576. Alexander Richmond Stocker, of Wolverhampton, impts. in preparing and fashioning iron; applicable to the manufacture of boot heels, tips, and horse shoes; and in part of the machinery or apparatus to be employed therein.—*June 23rd.*
1625. Josiah George Jennings, of Palace-road, Lambeth, and Manuel Leopold Jonas Lavater, of Bath-street, Newgate-street, impts. in stoppers and lids or covers for jars, bottles, and other vessels; also in closing and fastening other articles.—*June 30th.*
1653. Henry Broadhead and George Murdoch, of Portsmouth, impts. in breech-loading ordnance and gun carriages.—*July 3rd.*
1698. Thomas Preece, of Leominster, impd. corn and seed drill.—*July 8th.*
1739. Hugh Greaves, of Abingdon-street, Westminster, impts. in the construction of railways and tramways.—*July 11th.*
1871. Alexander Hector, of Montrose, impts. in means or apparatus for facilitating the catching of fish.—*July 28th.*
1918. Charles Gouty, of La Tour, near Bédarieux, France, impts. in fulling, thickening, felting, and cleansing cloths; and in apparatus connected therewith.—*August 4th.*
1993. Rudolph Wappenstein, of Manchester, method of preventing forgery of bankers' cheques and other documents, by the use of a stamp and a new apparatus whereby the issue of stamped documents is controlled.—*August 12th.*
2151. Alfred Vincent Newton, of Chancery-lane, impts. in the mode of, and apparatus to be used in, sewing by machinery,—a communication.—*August 31st.*
2165. Moritz Pinner, of South-terrace, Camberwell, the manufacture of a flexible translucent material or fabric, to be used as a partial substitute for glass,—a communication.—*September 2nd.*
2177. Nicolas Bailly, of Vesoul, France, impts. in the application of rolling friction to the axle boxes and journals of running shafts, and axle-trees of machines and vehicles of all descriptions, for lessening the resistance to the motion,—partly a communication.—*September 3rd.*
2207. Joseph Burch, of Crag Works, near Macclesfield, impts. in printing on certain and other Terry and velvet pile carpets, felted cloths, and other fabrics and materials; and in the processes and apparatus connected therewith.—*September 8th.*
2241. Louis Meyer, of Paris, impd. means of, and apparatus for, employing vapours, gases, and the heat

derived from combustible matters.—  
*September 11th.*

2300. Henry Charles Huskinson, of Manchester, impts. in the manufacture of buttons.—*September 18th.*

2308. James Fruser, of South-terrace, Camberwell, impd. method of constructing magazines for the safer and more economical storing of volatile oils in localities where the ground and labor are expensive,—a communication.—*September 19th.*

2359. Alfred Vincent Newton, of Chancery-lane, impts. in the manufacture of gunpowder, and powder for blasting purposes,—a communication.

2360. Henri Adrien Bonneville, of Paris, impts. in horse collars,—a communication.

2361. Henri Adrien Bonneville, of Paris, impts. in joining leather,—a communication.

*The above bear date September 24th.*

2373. Lucius Henry Norris, of Upper Bedford-place, Russell-square, impts. in the manufacture of India-rubber and gutta-percha compounds,—a communication.

2375. Edward Brown Wilson, of Parliament-street, impts. in furnaces and fire-places, applicable to the heating of steam boilers and other purposes.

*The above bear date September 26th.*

2376. Thomas Lowe, of Brighton, impd. break for railway and other carriages.—*September 28th.*

2396. Eliza Selene Attree, of Gibson-street, Waterloo-road, impd. cigar holder,—a communication.—*September 30th.*

2400. William Smith, of South-street, Finsbury, impd. process for re-crystallizing sugar.

2402. Thomas Bell, of Wishaw, Lanark, N.B., mode of manufacturing bricks and tiles.

2403. Henri Adrien Bonneville, of Paris, impts. in railway and other breaks,—a communication.

2404. Louis Napoleon Le Gras, of Rathbone-place, impts. in cooking stoves and apparatus.

2406. James Bell, of Linton, Cambridgeshire, impts. in couplings for railway carriages.

2408. George Dickey, of Southwark,

impts. in winkers or eye-screening apparatus for horses and other animals.

2410. Thomas Horsley, of York, impts. in breech-loading fire-arms.

*The above bear date October 1st.*

2412. James Farrar, of Halifax, impts. in machinery or apparatus for spinning and doubling wool, alpaca, mohair, cotton, silk, flax, and other fibrous substances.

2416. John Garrett Tongue, of Southampton-buildings, impd. compound reactive agent and universal mordant, to be employed in the processes of dyeing and printing,—a communication.

2418. John James Lundy, of Leith, and Robert Irvine, of Musselburgh, N.B., impts. in the manufacture of paper.

2419. William Augustus Torrey, of New York, impts. in lubricating the axles of railway carriages,—a communication.

2420. George Tomlinson Bousfield, of Loughborough-park, impts. in revolver fire-arms,—a communication.

2421. George Shepherd and William Thomas Shepherd, of Gt. Grimsby, impts. in restoring the crystals of lump or refined sugar which has been divided by saws, and in apparatus employed for this purpose.

2422. James Bowron, of South Stockton, Yorkshire, and George Robinson, of Welbeck-street, impts. in the manufacture of soda.

*The above bear date October 2nd.*

2423. Joseph Schofield, John Kirk, and William Spivey, of Huddersfield, impts. in looms for weaving.

2424. George Robert Tilling, of Birkenhead, and John Park, of Liverpool, impd. mode or method of filling tobacco pipes of an improved construction.

2425. Edward Brown Wilson, of the Strand, impts. in the manufacture of iron and other metals, and in the apparatus employed therein; parts of which are applicable for other purposes where high temperatures are employed, and also for ventilation.

2426. Thomas Fagg and Jesse Fagg,

of Panton-street, impts. in the manufacture of boots and shoes.

2427. Edmund Pratt, of Nottingham, impts. in finishing woollen fabrics made on twist lace machinery.

*The above bear date October 3rd.*

2429. William Hoehl, Christopher Brakell, and William Günther, of Oldham, impts. in rotary engines worked by steam, water, or other motive power.

2430. Christopher Brakell, William Hoehl, and William Günther, of Oldham, impts. in motive engines worked by water, steam, or other motive power,—a communication.

2431. John Martin Stanley and Jabez Stanley, of Sheffield, impts. in propelling.

2432. Charles Tomlison, of Great Barr, Staffordshire, impts. in taps, cocks, hydrants, or valves, and apparatus connected therewith, for opening, closing, regulating, and facilitating, and otherwise controlling the passage or flow of water, air, steam, gas, and other fluids and liquids.

2433. James William Guilmette, of Manchester, impd. substitute for whitening, pipe clay, and other analogous substances to be employed to produce a white coating or surface.

2434. William Henry Bailey, of Keighley, impts. in machinery for combing wool and other fibrous materials,—partly a communication.

2435. George Henry Ellis, of Bromley, impts. in, and application of, apparatus for aiding the combustion of fuel.

2437. Thomas Ivory, of Edinburgh, impts. in steam-engines, and in furnaces and boilers for the same.

2438. John Towlson, of Norwich, impts. in apparatus for cooling liquids.

2439. Robert Pepper, of Sheffield, impd. machine for pressing or crushing spent hops.

2440. William Legg, of Liverpool, impts. applicable to sewing machines.

*The above bear date October 5th.*

2441. Samuel Mathews, of Birmingham, impts. in breech-loading fire-arms.

2442. Edwin Whitehouse, of Wolverhampton, impts. in the manufacture of wrought-iron shackles.

2443. William Holgate, Henry Holgate, and Thomas Holgate, of Accrington, impts. in the manufacture of pickers used in weaving.

2444. Richard Archibald Brooman, of Fleet-street, impts. in steam boilers and furnaces,—a communication.

2445. William Batchelour, of Finsbury Pavement, impd. apparatus for moulding and modelling palates, teeth, and gums for dental purposes.

2446. George Dyer, of Regent-street, impts. in the construction of railway carriages.

2447. Alexander Johnston, of Comely Bank, near Edinburgh, impts. in railway carriages.

*The above bear date October 6th.*

2448. Edward Jones, of Gorton, near Manchester, impts. in apparatus to be used for pumping water out of mines and other places.

2449. David Barr, of Birmingham, impts. in apparatus for regulating and working window blinds.

2450. Elias Leak, of Longton, Staffordshire, impd. apparatus to be used in placing glost, china, and earthenware in ovens and kilns for firing, burning, or baking such ware.

2451. Joseph Caddick, of Birmingham, impts. in the manufacture of runners, runner notches, and top notches for umbrellas and parasols.

2452. George Frederick Graham, of Upper Gordon-street, Euston-square, impts. in high pressure cocks.

2453. Charles Pomeroy Button, of Leadenhall-street, impts. in lamps, especially applicable to the burning of hydrocarbons,—a communication.

2454. Charles Pomeroy Button, of Leadenhall-street, impts. in pumps,—a communication.

2455. Charles Pomeroy Button, of Leadenhall-street, impts. in harrows,—a communication.

2456. Raphael Zox, of Nelson-square, impts. in the manufacture of academic caps.

2457. Arthur Rigg, jun., of Chester, impts. in apparatus for propelling vessels,

2458. Edward Slaughter, of Bristol, impts. in locomotive engines.  
2459. John Gibson, of Sunderland, impts. in cast-iron pit tubbing.  
2460. George Whight, of Ipswich, imps. in washing apparatus,—a communication.  
2461. John Henry Johnson, of Lincoln's-inn-fields, impts. in the permanent way of railways,—a communication.

*The above bear date October 7th.*

2462. John Henry Johnson, of Lincoln's-inn-fields, impts. in propelling ships, and in the apparatus employed therein,—a communication.  
2463. Amédée Paulin Charpentier, of Paris, impts. in the manufacture of watches.  
2464. Caleb Crosswell, of Salisbury-street, impts. in breech-loading fire-arms,—a communication.  
2465. Michael Smith, of Dublin, impts. in washing, cleansing, salting, and packing butter, and in apparatus to be used therein.  
2466. Germain Canouil, and François Armand Blanchon, of Paris, shooting toy-fusees, toy rockets, or other similar toy missiles, by means of toy pistols or other toy fire-arms.  
2467. William Lorberg, of Wyldes-vents, Bermondsey, impts. in the manufacture of gas from tar.  
2468. James Dalziel Dougall, of St. James's-street, impts. in "camel guns" and other light artillery; which impts. are also applicable to "punt guns" or other heavy fowling pieces or rifles.  
2469. Robert Green Watson and William John Kendall, of Preston, impd. walking stick umbrella.  
2471. John Spencer, of Doncaster, impts. in machinery for separating different sizes of roots.  
2472. Alfred Vincent Newton, of Chancery-lane, impts. in the construction of condensers,—a communication.

*The above bear date October 8th.*

2474. James Wood, John Whitehead, and Thomas Tetlow, of Oldham, impts. in machinery or apparatus for governing the speed of steam engines.  
2475. Joseph Elsom, of Regent's-row,

Dalston, impts. in parallel turning, and in machinery for that purpose.

2476. Enoch Watkin James, of Bryn-llys, Cardiganshire, impd. apparatus and arrangements for giving buoyancy to, or raising, sinking or submerged ships, and other sinking or sunken bodies.  
2477. George Parry, of Ebbw Vale Iron Works, impts. in refining crude pig iron, and in furnaces connected therewith.  
2478. John McInnes, of Liverpool, impts. in sheathing for navigable vessels of iron or wood; which sheathing is also applicable to the covering of roofs, walls, and other purposes.  
2479. James Mather, of Crow Oaks, near Radcliffe, impts. in friction or glazing calendars.  
2481. Noah Fellows, of Chancery-lane, impd. method of extinguishing fires in chimneys and flues, regulating and promoting draught therein; calculated also to act as a ventilator.

*The above bear date October 9th.*

2484. George Waide Reynolds, of Smethwick, impd. manufacture of bands or strips for crinolines.  
2485. John Vaughan, of Middlesbrough, impd. apparatus for purifying waste gases from blast and other furnaces.  
2487. Julius Ruthardt and Ferdinand Thiele, of Oxford Market, impts. in apparatus for purifying and increasing the illuminating power of gas.  
2488. William Brookes Fairbanks, Joseph Lavender, and Frederick Lavender, of Walsall, impts. in the manufacture of hames.  
2489. Duncan Proudfoot, of Glasgow, impts. in printing or dyeing textile fabrics.  
2490. John Wesley Goundry, of Old Shildon, near Darlington, impts. in musical instruments.  
2491. Thomas Hughes, of Wolverhampton, impts. in the manufacture of lanthorns.

*The above bear date October 10th.*

2492. Alexander Inglis, of Arthur-road, Holloway, impts. in taps or cocks; part of which impts. is applicable to the lubrication and pro-

- tection of the journals of revolving shafts, axles, or spindles.
2493. Peter Rothwell Jackson, of Salford, impts. in the manufacture of hoops and tyres for railway wheels and other purposes, and in the machinery employed therein.
2494. William Hutchison, of Cardington-street, impts. in the manufacture of fittings for powder flasks.
2495. John Galley Hartley, of Lawrence. Pountney-lane, impts. in the construction of iron and wooden ships and other vessels.
2497. William Tarleton Bury, of Sheffield, impt. in vessels or baths for containing heated metals and fluxes employed in the processes of hardening and tempering steel and steel articles.
2498. Thomas Browning, of Liverpool, impts. applicable to metallic casks, and the machinery for the manufacture of the same.
2499. Thomas Gidlow, of Heaton, Lancashire, impts. in bearings for axles for railway or other carriages.
2500. Thomas Fox, of Ballingdon, near Sudbury, impd. apparatus for cleaning out the tubes of steam boilers; which apparatus is also applicable for cleaning out other tubes.
2501. William Edward Gedge, of Wellington-street, impts. in shears for cutting metals and other substances,—a communication.
2503. Russel Aitken, of Cambridge-street, Pimlico, impts. in the permanent way of railways.
2505. James John Anderton, of Northampton, impts. in machinery for cutting and finishing the edges of the soles and heels and the bottoms of boots and shoes.
- The above bear date October 12th.*
2506. James Dodge, of Waterford, U.S.A., impts. in machinery for rolling, shaping, or forging metals, and in apparatus for grinding and polishing the same.
2507. George Morgan, of Budge-row, sample bag for postal and other purposes.
2508. John Edgar Poynter, of Glasgow, impts. in throwing projectiles by means of explosive agents, and in apparatus therefor,
2509. Joseph Place, of Hoddlesden, Lancashire, impd. application of certain schistous or shaly materials to the manufacture and finishing of paper.
2510. Alfred Rolfe, of Amwell-street, Pentonville, impts. in means or apparatus for propelling carriages on railways, tramways, or on common roads.
2511. Thomas Cowell Craven, of Greenbush, New York, impts. in cotton gins.
2512. Thomas Scott, of Nelson-square, Blackfriars, impts. in floating docks.
2513. John Fowler, of Leeds, impts. in apparatus used for hauling agricultural implements.
- The above bear date October 13th.*
2515. John Rowley, of Leeds, impts. in apparatus for washing, scrubbing, scouring, bleaching, and discharging impurities or other matters from woven or other fibrous materials.
2516. Joseph Inchley, of Birmingham, impts. in valves for double-cylinder steam engines.
2517. Ewing Pye Colquhoun and John Pardoe Ferris, of Lawrence Pountney-hill, impts. in fire bars for the furnaces of steam boilers, and the mode of mounting the same.
2518. Marcelin François Dorothé Cavalerie, of Paris, impts. in obtaining centrifugal motive power.
2519. James Milton, of Paisley, impts. in looms for weaving.
2520. William Jackson Rideout, of Bolton, impts. in boiling rags and other paper-making materials.
2521. Ossian Esaias Sonnenstein, of the Circus, Minorities, impts. in reflecting apparatus,—a communication.
- The above bear date October 14th.*
2524. Richard Bewley, jun., of Uttoxeter, impts. in wrenches.
2525. Peter Lesley, of Philadelphia, U.S.A., impts. in the manufacture of rails for railways,—a communication.
2527. Stephen Randoll Smith, of Delamere-street, Paddington, impts. in apparatus for connecting chain cables, and for clearing a ship's hawse when foul, and also in apparatus for acting on and presenting strain to the chain

cables when ships are riding at anchor.

2528. Herbert William Hart, of Fleet-street, impts. in apparatus for suspending T and other like fastenings and articles to which they are applied.  
2529. Baldwin Fulford Weatherdon, of Kingston-on-Thames, apparatus for rubbing off or removing the dust or dirt from boots or shoes.

*The above bear date October 15th.*

2531. James Polglase, of Bodmin, and Jonathan Cox, of Manchester, impd. apparatus for boring and cleaving stone.  
2532. Esau Rowing, of Norwich, impts. in steam engines and boilers.  
2533. Richard Archibald Brooman, of Fleet-street, impts. in pumps to be worked by steam,—a communication.  
2534. François Antoine Edmond Guirouet de Massas, of Hoxton, impts. in smut machines, and in machines for cleansing and peeling grain and seeds.  
2535. Frederick George Stuber, of Waterloo-road, impts. in lamps and stoves for the application of blast heat to horticultural, agricultural, and other specified purposes.  
2536. Samuel Jay, of Regent-street, impts. in the manufacture of stockings and drawers.

*The above bear date October 16th.*

2537. Moritz Meisel, of Park-walk, Brompton, impts. in apparatus for ascertaining the weight of the load supported by the springs of railway locomotives and carriages, for the purpose of regulating or equalising such load,—a communication.  
2538. Samuel Berrisford and William Ainsworth, of Stockport, impts. in looms for weaving.  
2539. John Shanks, of Barrhead and Greenock, Renfrewshire, N.B., impts. relating to water-closet and other valves or taps.  
2540. William Hampson, the younger, of Dukinfield, impts. in looms for weaving.  
2541. William Routledge and Frederick Francis Ommanney, of Salford, impts. in "baling boxes" used in packing cotton or other fibrous materials.

2542. William Clark, of Chancery-lane, impts. in rotary engines,—a communication.

2544. William Clark, of Chancery-lane, impts. in sewing and embroidering machines,—a communication.

2545. Lewis Reese Chesbrough, of Brooklyn, U.S.A., impd. let-off motion for looms,—a communication.

2547. William Darlow, of North Woolwich-road, Essex, and Robert Henry Lawson, of Victoria-terrace, Essex, impts. in apparatus or means for obtaining motive power.

2548. John Wright, of the Esplanade, Rochester, impts. in machinery for cutting railway sleepers to receive railway chairs.

2549. Edward Henry Cradock Monckton, of Regent-street, impts. in the means of uniting or joining plates or sheets of metal; which invention is applicable to the construction of boilers, tubes, and other useful purposes.

2550. Fédor de Wyldé, of Trinity-square, Tower-hill, impts. in the induration of stone, cement, stucco, brick, or other analogous materials; also in the manufacture of artificial stone.

2551. Fédor de Wyldé, of Trinity-square, Tower-hill, impts. in the separation of molasses and other impurities from sugar crystals,—a communication.

*The above bear date October 17th.*

2552. James Champion, of Manchester, impts. in machinery or apparatus for preparing, spinning, and doubling cotton, flax, wool, and other fibrous materials.

2553. Henry Gilbee, of South-street, Finsbury, impd. composition for rendering boots and shoes and other similar articles waterproof,—a communication.

2555. Arnold Budenberg, of Manchester, impd. blasting powder,—a communication.

2556. Joseph Whitley, of Leeds, impts. in the permanent way of railways.

2558. William Clark, of Chancery-lane, impts. in separating ores from their gangues, and in apparatus for the same,—a communication.

*The above bear date October 19th.*

2559. James Taylor, James Lees, and John Lees, of Oldham, impts. in machinery or apparatus for opening, cleaning, and mixing cotton or other fibrous materials.
2560. Ernest Henry Luebbbers, of Liverpool, impd. treatment of textile substances, to obtain a species of, or substitute for, cotton,—a communication.
2561. William Ingham, of Manchester, and Isaac Wood, of Pendleton, near Manchester, impts. in the manufacture of copper rollers used for printing calico or other materials.
2562. Cornelius Thomas Morley, of Birmingham, causing a more complete combustion of gas in using it for lighting purposes.
2563. David Mills, of Birmingham, impts. in the manufacture of moulds for casting studs for chains.
2564. Joseph Vaughan, of Birmingham, impts. in the manufacture of pecks, hoes, adzes, and other edge tools, and in tools to be used in the said manufacture.
2565. James Michaelis, of Cannon-street West, impts. in the manufacture of purses, pocket books, and wallets, and in the construction of double-action locks for the same and other similar purposes.
2567. Henry Hennessey, of Charleville-road, Dublin, impd. in projectiles.
2569. John Bryant, of Edgware-road, impts. in vent apparatus for facilitating the drawing off or letting off fluids.
2570. Henry Bernoulli Barlow, of Manchester, impts. in shoes, boots, and other coverings for the feet,—a communication.
2571. William Adam Dixon, of Glasgow, impts. in making aluminate of soda and other aluminous salts.
2572. George Davies, of Serle-street, impts. in forming stitches over the edges of fabrics, and in the machinery connected therewith,—a communication.
2573. John William Nottingham, of Clayton-place, Kennington-road, impts. in hansom cabs; part of which impts. are also applicable to other wheeled carriages.
2574. George Heaton Daglish and Thomas Windus, of St. Helen's, Lancashire, impts. in machinery for bending plates for iron ships and other like purposes.
2575. Charles Garton, of Bristol, and Thomas Hill, of Southampton, impts. in evaporating, cooling, and melting, and in apparatus employed therein.
2576. William Nelson Hutchinson, of Plymouth, impts. in ordnance.
2577. Thomas Restell, of Water-lane, impd. construction of walking-stick umbrella.
- The above bear date October 20th.*
2578. William Hartcliffe, of Salford, impts. in mules for spinning and doubling.
2579. Thomas Charles Clarkson, of Stamford-street, impts. in the manufacture of saddles and harness, and in materials for and in ornamenting the same; which impts. are applicable for parts of carriages, dress, and coverings for the head, and other articles.
2580. Joseph Hinton, of Birmingham, impts. in breech-loading fire-arms.
2581. Christian Schiele, of Manchester, impts. in governors.
2582. Nathaniel Fortescue Taylor, of Stratford, Essex, impts. in increasing the illuminating power of coal gas, and in the means or apparatus employed therein.
2583. Gilbert Howell, of Hawarden Iron Works, near Holywell, impts. in apparatus for condensing metallic and other fumes.
2584. Thomas Hodson, William Nightingale, and Robert Laird, of Preston, impts. in machinery for carding cotton and other fibrous materials.
2586. Emile Alcan, of King-street, City, impd. method of figuring and ornamenting cloths and other fabrics, and apparatus employed therein,—a communication.
2587. Richard Archibald Brooman, of Fleet-street, impts. in treating ligneous substances, in separating and recovering the fibrous portions therefrom, in preparing, bleaching, and sizing the same, and in machinery employed therein,—a communication.
2588. Zerah Colburn, of Upper Bedford-place, Russell-square, impts. in steam engines.

2590. John Dodd, of Oldham, impts. in mules for spinning and doubling.

2591. William Edward Newton, of Chancery-lane, impt. in sewing machines,—a communication.

*The above bear date October 21st.*

2592. George Cutler, jun., of Wenlock-road, City-road, impts. in boilers and apparatus used for the generation of steam.

2593. Robert Baillie, of the Isle of Dogs, impts. in the construction of floating docks.

2594. Henry Wilson, of Stockton-upon-Tees, impd. lubricator for steam engines.

2596. Alexander Angus Croll, of Coleman-street, impts. in the preparation of matters to be employed as disinfectants.

2597. Charles Fusnot, of Chaussée de Waterloo, St. Gilles-lez-Bruxelles, impts. in the manufacture of cartridge bottoms or entire cartridges, composed entirely of the same elements.

2598. John Walter Friend, of Southampton, and Baldwin Fulford Weatherdon, of Kingston-on-Thames, impd. valve and valve gear for regulating the passage or flow of fluids.

2600. James Mitchell, of Dyke Head, Lanarkshire, impts. in sinking, quarrying, and excavating in the earth.

2601. Charles Parker, of Dundee, impts. in machinery or apparatus for winding yarns or threads.

2602. John Weemes, of Johnstone, Renfrewshire, N.B., impts. in machinery, apparatus, or means for drying, cleaning, and cooling grain and other vegetable products.

2603. Arthur Kinder, of Cannon-street, City, and John Inglis, of Old Ford, impts. in the manufacture of metallic foils, and in the apparatus to be employed therein.

2604. Benjamin Noakes and Frederic John Wood, of Bermondsey, impts. in the manufacture of metallic casks, bottles, and other similar vessels, and in machinery employed therein.

2605. Charles James Pownall, of Jermyn-street, impts. in preparing and cleansing vegetable fibres, and in machinery employed therein.

2606. William Wharton Burdon, of

Newcastle-upon-Tyne, impts. in reducing and preparing wood for the manufacture of paper and pulp.

2607. Richard Archibald Brooman, of Fleet-street, material for tanning,—a communication.

2608. Henry Bridson and John Alcock, of Bolton, impts. in machinery for plaiting or folding fabrics.

2609. Thomas Dickins, Albert Lungley Dickins, and Harvey Heywood, of Middleton, Lancashire, impts. in dyeing threads of silk.

2610. Archibald Turner, of Leicester, impts. in looms for weaving.

*The above bear date October 22nd.*

2611. Jürgen Lorenz Jürgens, of Oldsum, Denmark, impts. in vessels of war.

2613. Mary Anne Boyle, of Claremont House, Kensington, impts. in portable writing cases and dispatch boxes.

2614. Alfred Joseph Martin, of Vernon-terrace, Bow, impd. burner for burning petroleum, paraffin, or other hydro-carbon oils; consuming the smoke without the use of a draught chimney.

2615. Joseph Claes, of Paris, impd. apparatus for regulating the emission of gas,—a communication.

2616. Joseph Thomas Webster, of Mansfield, Nottinghamshire, impts. in driving the spindles of doubling and spinning frames.

2618. Victor Julien Cassaignes, of Paris, impts. in the manufacture of the prisms, lenses, and glasses of stereoscopes, and in ornamenting glass.

2619. Frederick Tolhausen, of Paris, impd. mechanism for regulating the working of springs,—a communication.

2620. James Parker, of Lilford-road, Camberwell, impts. in the application of steam combined with air as a motive power, and for other purposes.

2621. Alfred Vincent Newton, of Chancery-lane, impd. mode of manufacturing railway wheels,—a communication.

*The above bear date October 23rd.*

2623. William Betts, of Wharf-road, City-road, impts. in the manufacture of metallic capsules for bottles and



- similar vessels, and in the apparatus or means for applying or fixing such capsules thereon.
2624. Edward Smith Crease, of Tavistock, impts. in machinery for drilling, boring, or excavating rock or other earthy substances.
2625. John Davidson, of Leek, Staffordshire, impts. in doubling yarns or threads of silk and other fibrous substances, and in the machinery employed therein.
2626. James Thomas, of Great Bolton-street, Kennington, impts. in gas meter indicators.
2627. George Haseltine, of Southampton-buildings, an attachment to coverings for the head, and to other articles of dress, for lighting matches,—a communication.
2628. Francis Bryn Baker, of Nottingham, impts. in apparatus used in dressing lace and other textile fabrics, and suitable also to the application of dyes or coloring matters thereto.
2629. James Brown, of Aldgate, and John Thomas Way and Thomas Mullett Evans, of Leadenhall-street, impts. in preparing cements and varnishes.
2630. William Locke and John Warrington, of Kippax, near Leeds, and William Elliot Carret, William Ebenezer Marshall, and John Telford, of Leeds, impts. in the working and mining of coal, minerals, and earthy matters; and in the machinery, apparatus, and means to be employed therein.
2631. Louis Joseph Hannart, of Brussels, impd. clasp or fastening for gloves or other wearing apparel, for umbrellas, travelling bags, or other similar objects.
2633. Alexander Sellar, of Reading, impd. instrument for lubricating rifles and other descriptions of fire-arms, also ordnance.
2634. Benjamin Browne, of King William-street, City, impts. in sewing machines,—a communication.
2635. Alexander Alison, of Sloane-street, impts. in atmospheric railways, and in carriages for the same.
- The above bear date October 24th.*
2636. Richard Littleboy, of Bromley, Middlesex, impts. in the manufacture of nosebags.
2637. Bernhard Steinmetz, of Paris, impts. in locks for bags.
2638. Frederick Parker, of Cambridge, impts. in carriages.
2639. Theophilus Marsh, of Sheffield, impts. in projectiles.
2640. Samuel James Healey, of Manchester, impts. in water gauges; applicable to steam boilers and other purposes.
2641. Marius Vian, of Marseilles, compositions for preserving iron ships and other submerged ironwork from corrosion and from fouling.
2642. James Nicholas, of Newton, Lancashire, impts. in treating Canadian petroleum, and other mineral oils of a similar nature.
2643. William Edward Gedge, of Wellington-street, impd. pillow,—a communication.
2645. James Willcox, of Ludgate-hill, impts. in sewing machines,—a communication.
2646. Alfred Blake, of Newport, Monmouthshire, impd. refrigerator for cooling worts for brewing, or other liquids requiring cooling, and for improving brewers' refrigerators now in use.
2647. Edward Clifton and Benjamin Greenwood, of Manningham, Yorkshire, impts. in the manufacture of brushes used in machinery employed for preparing and combing wool, cotton, silk, and other fibrous substances.
- The above bear date October 26th.*
2648. John Marshall, of Pentonville-road, impts. in the expression of oil from oil-yielding substances, and in the production of oil cake and other residuary matters.
2649. Thomas Hunter Holderness, of Liverpool, impts. in propelling navigable vessels.
2651. Thomas Grason, of Manchester, impts. in boots, shoes, clogs, and such like coverings for the feet.
2653. William Livingstone, of Glen-gall-road, Poplar, impd. machine for punching, shearing, and rivetting metals.
2654. John Hutchinson and James

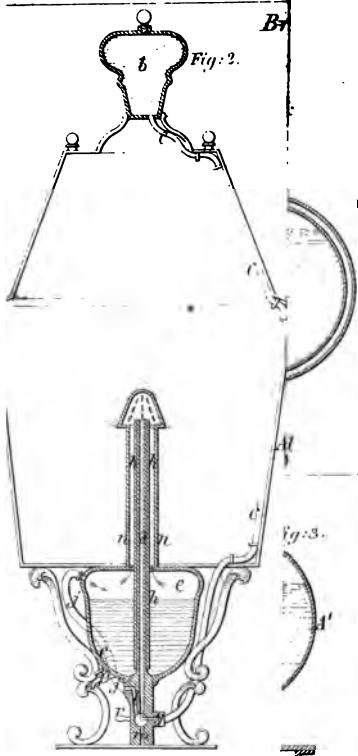
- Hollingworth, of Dobercross Saddleworth, Yorkshire, impts. in means or apparatus employed in weaving.
2655. Patrick Benignus O'Neill, of Warwick-street, Regent-street, impd. salinometer, which is applicable also as a hydrometer, and for other similar or analogous purposes.
2656. Robert Smith, of Manchester, impts. in doubling and winding machines.
2657. Edward Richard Hollands, of Charles-street, Northampton-square, impts. in machinery for punching, cutting, and pressing metals and other materials.
2658. Mark William Carr, of the Knoll, Blackheath, impts. in the manufacture of wooden sleepers for railways.
2659. William Firth and Samuel Firth, of Burley, near Leeds, and John Sturgeon, of Leeds, impts. in machinery for cutting and boring coal, stone, or other minerals.
- The above bear date October 27th.*
2660. William Wanklyn, of Bury, Lancashire, impts. in apparatus for opening and conditioning cotton and other fibrous substances.
2661. James Marshall, of Stockport, impts. in apparatus for applying adhesive substances to spindles employed in spinning cotton and other fibrous materials, and for the lubrication thereof.
2662. Abraham Senior Coronel, of High Holborn, impd. preparation of tobacco for fumigating purposes.
2664. Stephen Procter, of Elsecar, Yorkshire, impd. instrument for extracting corks from bottles.
2665. Edward Oldfield, of Salford, impts. in self-acting mules for spinning and doubling cotton and other fibrous materials.
2666. Henri Adrien Bonneville, of Paris, impt. in clasps for portemonnaies, pocket books, bags, and other like uses,—a communication.
2667. Richard Needham, of Dukinfield, and James Pollitt, of Heywood, impd. equilibrium valves for steam engines and other purposes.
2668. James Cavanah and John Cavanah, of Parron-street, Paddington, impts. in machinery or apparatus for making bricks and tiles; applicable also for washing and drying clay.
2669. Michael Henry, of Fleet-street, impt. in, or addition to, military knapsacks, travelling bags, and other similar articles,—a communication.
2670. William Nall, of Leicester, impts. in ornamenting glass and sheet gelatine.
2671. George Edmund Donisthorpe, of Leeds, impts. in apparatus used when getting coal and other minerals.
2672. Robert Baker Jones, of Lime-  
rick, impts. in portable cooking apparatus.
2673. John Kennedy, of Whitehaven, impts. in the construction of ships of war and other vessels, and in masting and rigging the same.
2674. Richard Archibald Brooman, of Fleet-street, impts. in instruments for taking astronomical and other observations,—a communication.
- The above bear date October 28th.*

### New Patents Sealed.

- |                                       |                                          |
|---------------------------------------|------------------------------------------|
| 1022. J. Cornes and J. C. Davis.      | 1092. C. P. Stewart and J. Kershaw.      |
| 1033. J. P. Nunn and E. B. Nunn.      | 1093. Joshua Appleby.                    |
| 1050. Maurice Nalkenhuyzen.           | 1097. William Clissold.                  |
| 1053. Frederick Bennett.              | 1098. W. G. Craig.                       |
| 1056. W. Hudson and C. Catlow.        | 1104. James Purdey.                      |
| 1061. Samuel Crabtree.                | 1107. J. T. Oakley and T. Oakley.        |
| 1062. G. Hall and J. Wells.           | 1110. John Fortune.                      |
| 1063. Arthur Kinder.                  | 1112. B. G. Sloper.                      |
| 1069. Thomas Moore.                   | 1116. William Walsh.                     |
| 1077. W. Tarr and E. Farr.            | 1122. Peter Bradshaw.                    |
| 1079. E. Leigh and F. A. Leigh.       | 1124. William Glover.                    |
| 1082. M. Barland & E. H. C. Monckton. | 1127. Thomas Sagar.                      |
| 1087. John Webberley.                 | 1130. S. Hibbert, J. Lawton, and J. Kay. |

1131. S. D. Mac Kallen.  
 1132. I. M. Singer.  
 1133. George Davies.  
 1135. Archibald Sturrock.  
 1138. James Park.  
 1143. G. Bower and A. Dick.  
 1145. John Bettridge.  
 1146. C. A. Day, A. Lamb, and T. Summers.  
 1149. P. J. Livsey.  
 1151. Henry Schooling.  
 1153. C. L. Braithwaite and J. Hirst.  
 1154. J. H. Bailey.  
 1157. E. Chamouin-Boët.  
 1158. C. F. Bielefeld.  
 1160. William Thomson.  
 1161. James Stickland.  
 1164. James Norie.  
 1172. James Burrell.  
 1173. C. H. G. Williams.  
 1174. James Burrell.  
 1177. Benjamin Hargreaves.  
 1178. Robert Burgess.  
 1179. C. and W. Shorrocks.  
 1183. R. A. Brooman.  
 1186. J. E. McConnell and G. H. Bovill.  
 1187. Benjamin Lilly.  
 1189. Thomas Warren.  
 1191. J. E. McConnell and G. H. Bovill.  
 1192. William Whiteley.  
 1195. R. A. Brooman.  
 1197. R. A. Brooman.  
 1199. R. A. Brooman.  
 1200. Henry Wilde.  
 1201. T. Parkinson and F. Taylor.  
 1203. J. E. McConnell and G. H. Bovill.  
 1206. Benjamin Lambert.  
 1208. James Farmer.  
 1209. R. A. Brooman.  
 1210. Thomas Lawrence.  
 1212. Alexander Pilbeam.  
 1219. Isaac Parker.  
 1220. B. Shillito and D. Moor.  
 1222. D. M. Fyfe.  
 1224. Alexander Macmillan.  
 1225. R. T. Mallet.  
 1226. John Patterson.  
 1229. Benjamin Browne.  
 1230. James Hinks.  
 1231. Robert Talbot.  
 1232. F. M. Burns.  
 1234. J. T. Newton.  
 1235. Joseph Gibbs.  
 1236. William White.  
 1238. E. B. Wilson.  
 1239. James Whitehead.  
 1241. William Watson.  
 1243. Alfred Heather and J. Redfern.  
 1245. R. Fenner and W. H. Hight.  
 1248. C. Barnard, J. Bishop, C. Barnard, jun., and G. Barnard.  
 1253. Richard Bunting.  
 1254. H. J. Olding.  
 1267. J. T. Markall.  
 1269. G. R. Harding.  
 1270. William Walker.  
 1272. William Nunn.  
 1273. F. P. Warren.  
 1275. N. J. Amies.  
 1277. W. H. Clapp.  
 1278. Edward Sonstadt.  
 1280. Josiah Goodman.  
 1281. R. A. Brooman.  
 1293. E. Barlow, J. Ashworth, J. Newhouse, F. Hamilton, & W. Hope.  
 1296. S. E. Rosser and J. G. Jennings.  
 1306. James Hesford.  
 1307. William Muir.  
 1309. H. A. Bonneville.  
 1320. William Clark.  
 1326. F. W. Kitson and J. Kitson.  
 1332. H. J. Kennard.  
 1335. F. R. Piltz.  
 1338. George Gore.  
 1341. C. F. Baxter.  
 1362. William Clark.  
 1367. L. L. Chichester.  
 1379. E. J. Jarry.  
 1431. Charles Nicquet.  
 1447. William Clark.  
 1485. J. S. Benson and D. Jones.  
 1487. J. G. Bass and W. Bass.  
 1499. William Clark.  
 1522. Alexander Samuelson.  
 1579. S. Robinson, J. Priestly, and J. Foulds.  
 1724. William Clarke.  
 1753. L. M. Bournigues and J. B. Vidard.  
 1754. L. M. Bournigues and J. B. Vidard.  
 1758. J. Holmes, G. T. Holmes, and F. R. Holmes.  
 1782. Henry Elliott.  
 1791. Nathan Thompson.  
 1836. Charles Beslay.  
 1899. A. R. Arrott.  
 1962. John Thornton, James Thornton, A. Thornton, and W. Thornton.  
 2072. W. E. Newton.  
 2087. L. E. C. Martin.  
 2108. Theophilus Westhorp.  
 2128. John Alison.  
 2132. H. W. Putnam.  
 2142. Alexander Rowand.  
 2144. L. E. C. Martin.  
 2188. George Hargreaves.  
 2226. A. V. Newton.  
 2239. T. J. Sloan.  
 2320. William Elsdon.

\*.\* For the full titles of these Patents, the reader is referred to the corresponding numbers in the List of Grants of Provisional Specifications.



*Bowditch's gas carburator.*

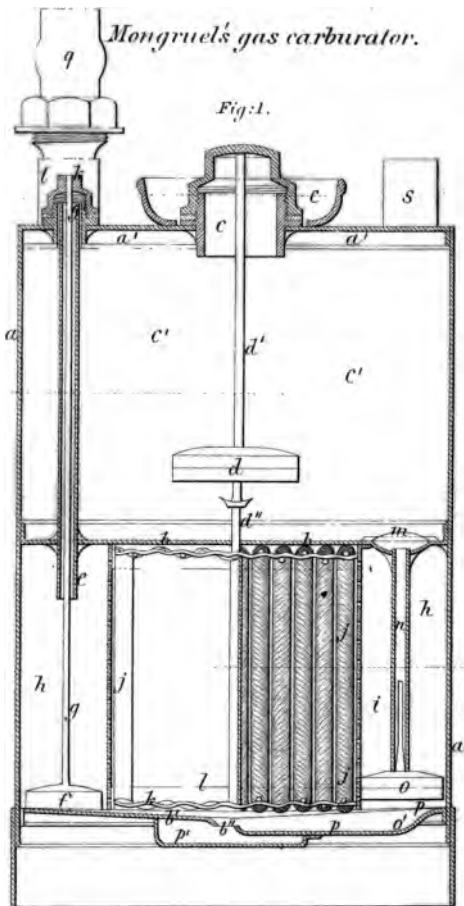
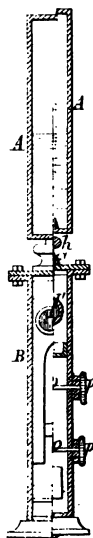
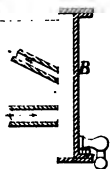
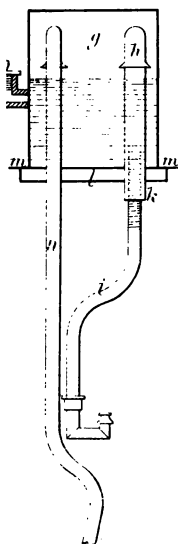
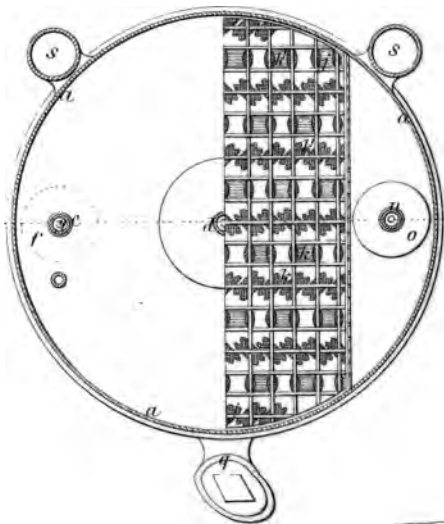
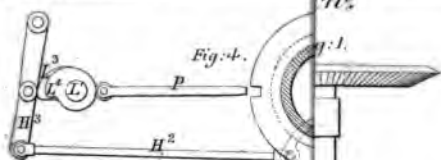


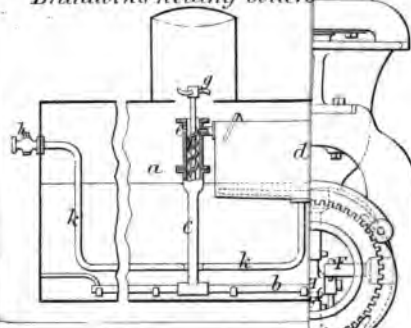
*Fig. 2.*





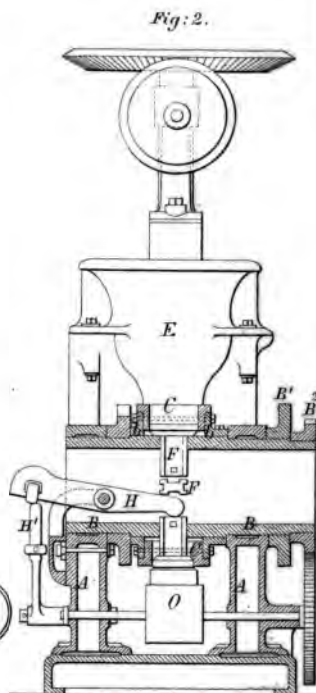
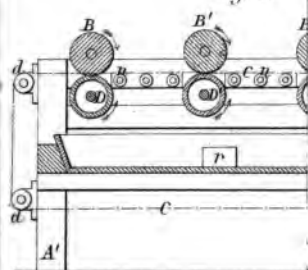


*Braddock's feeding boilers*



*Newton's brew*

*Fig. 3.*



*Tatham's warp lace.*

*Fig. 1.*

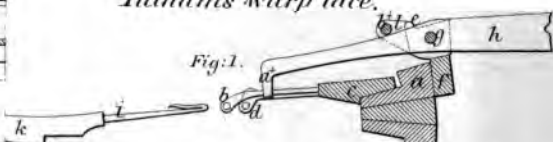


*Fig. 2.*

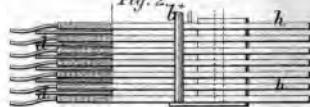


*Fig. 3.*

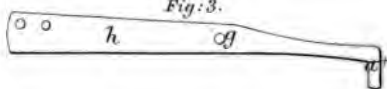


*Fig. 2.*

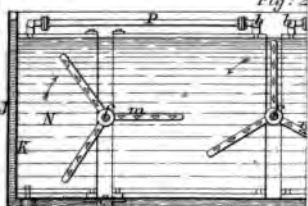


*Fig. 2.*

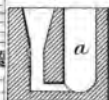
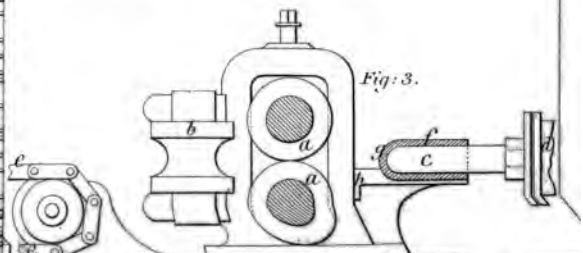
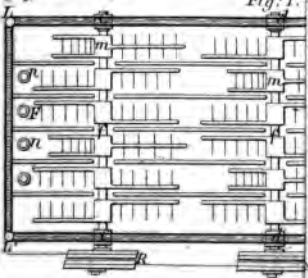
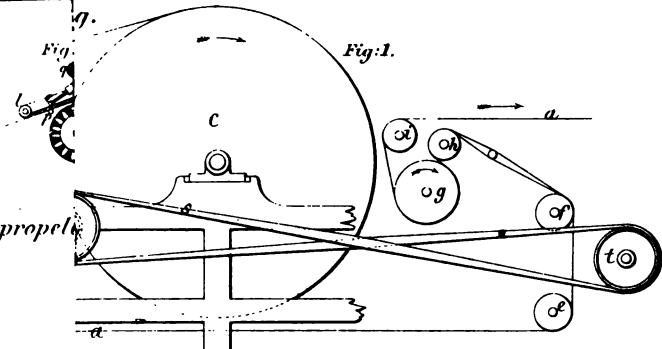
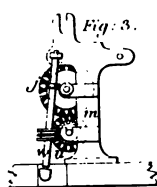


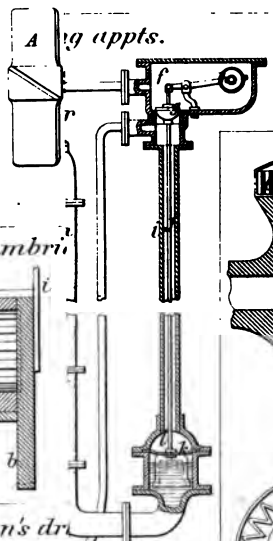
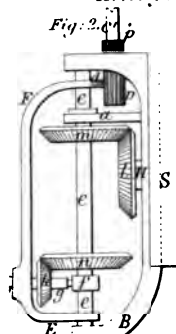
*Fig. 1. issiere's tube making mach<sup>y</sup>*







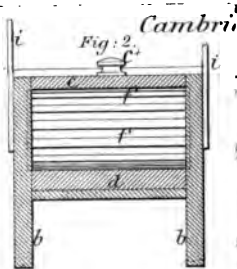
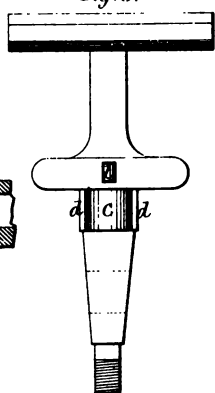
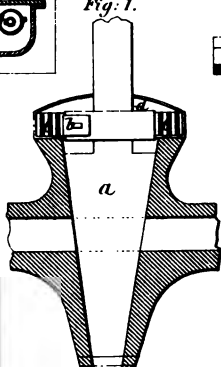
Henry's propeller



Robertson & White's cocks.

Fig. 1.

Fig. 3.



Cambri

Sauderson's dr

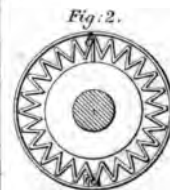
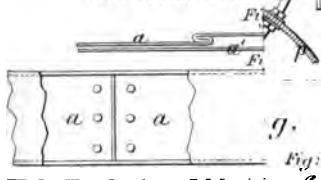


Fig. 2.

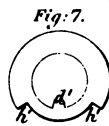


Fig. 7.

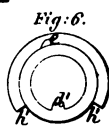


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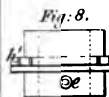


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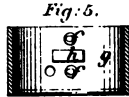


Fig. 5.

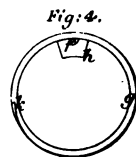


Fig. 4.

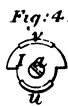
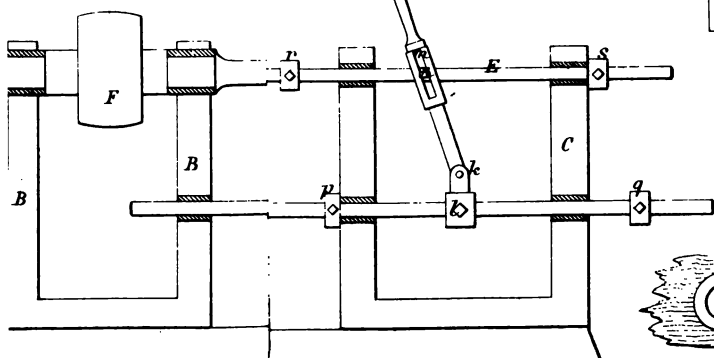


Fig. 4.

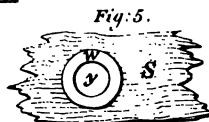
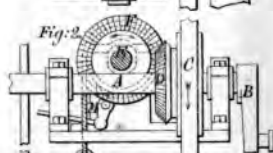
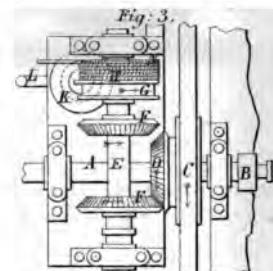
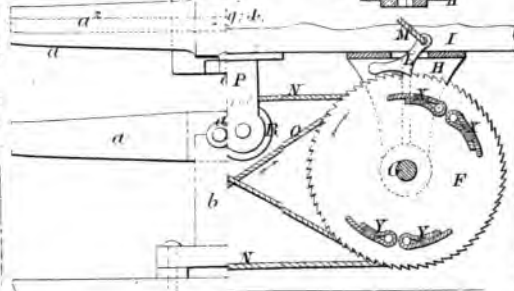
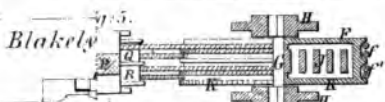
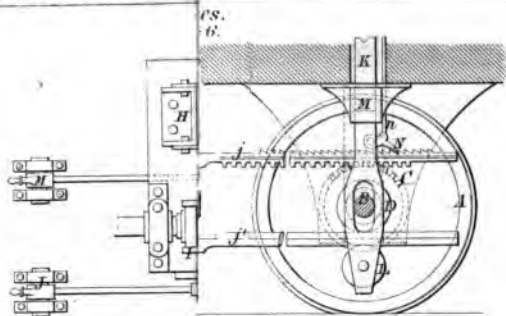


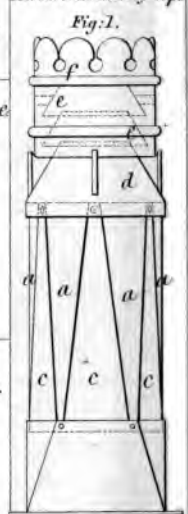
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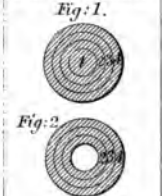




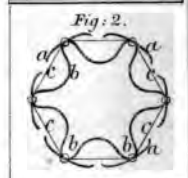
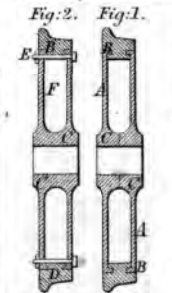
Carters' chimney tops



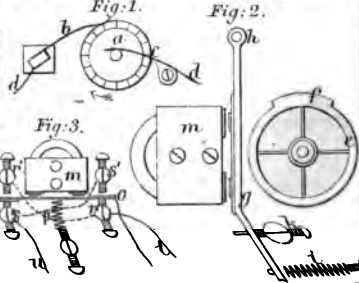
Vickers' ordnance



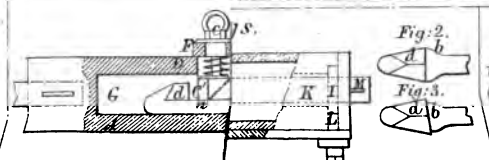
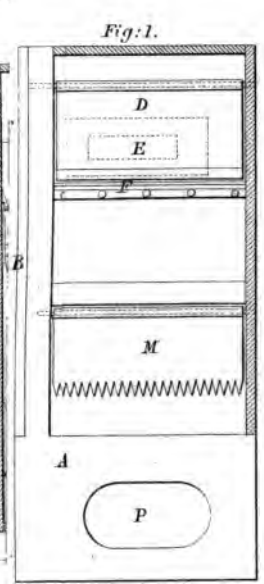
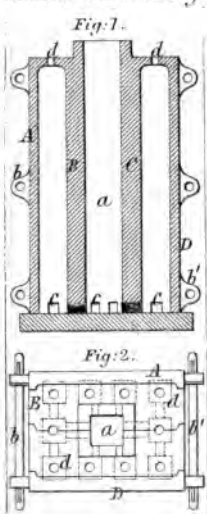
Wilson's railway wheels.



Bakewell's electric telegraphs.

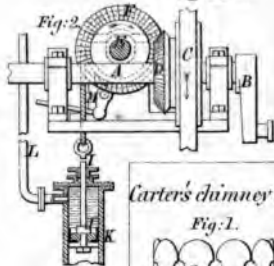
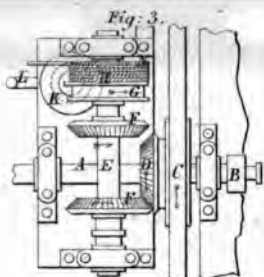
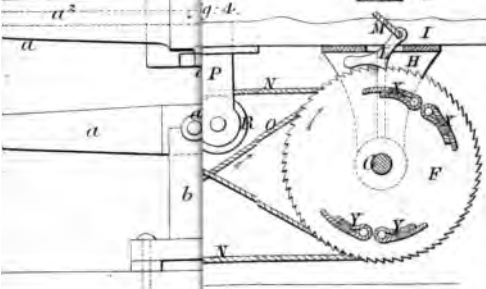
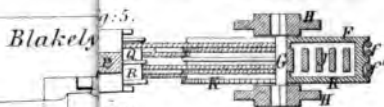
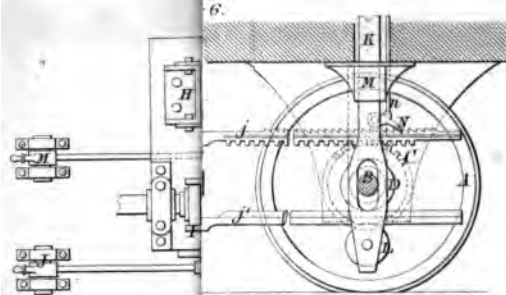


Johnson's moulding.



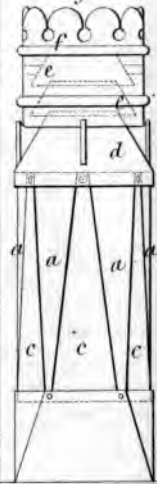


es.  
6.



Carters' chimney tops

Fig. 1.



Vickers' ordnance

Fig. 1.



Fig. 2.



Wilson's railway wheels.

Fig. 2. Fig. 1.

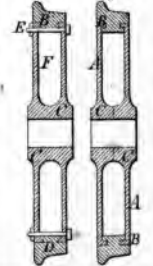


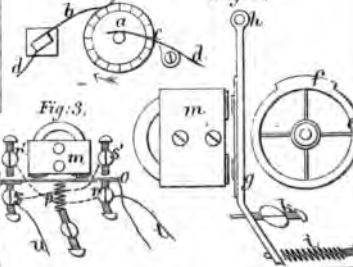
Fig. 2.



Bakewell's electric telegraphs.

Fig. 1.

Fig. 2.



son's moulding.

Fig. 1.

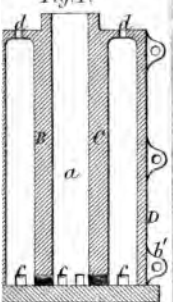


Fig. 2.

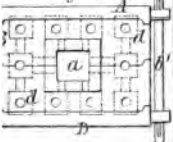


Fig. 1.

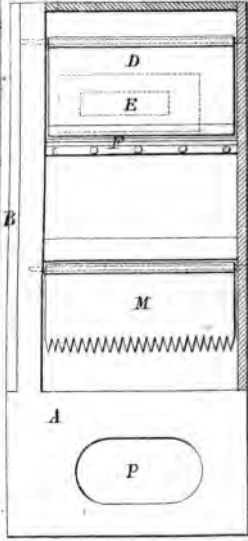


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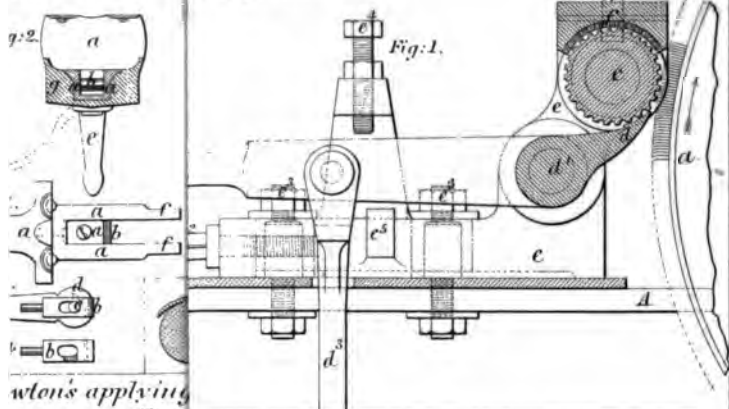


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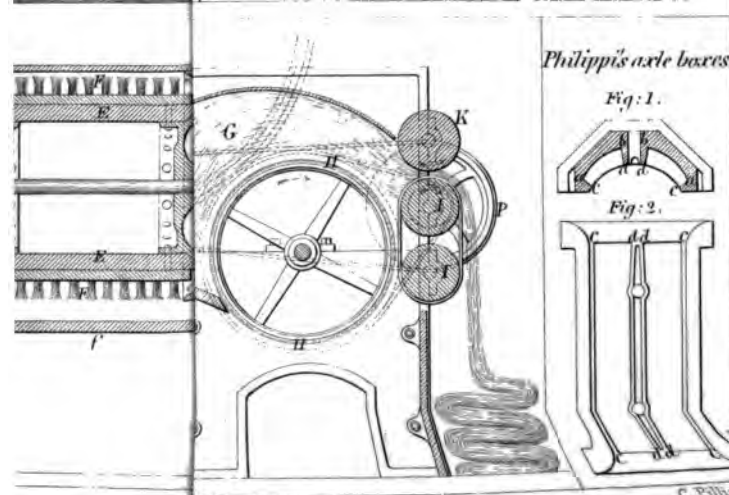
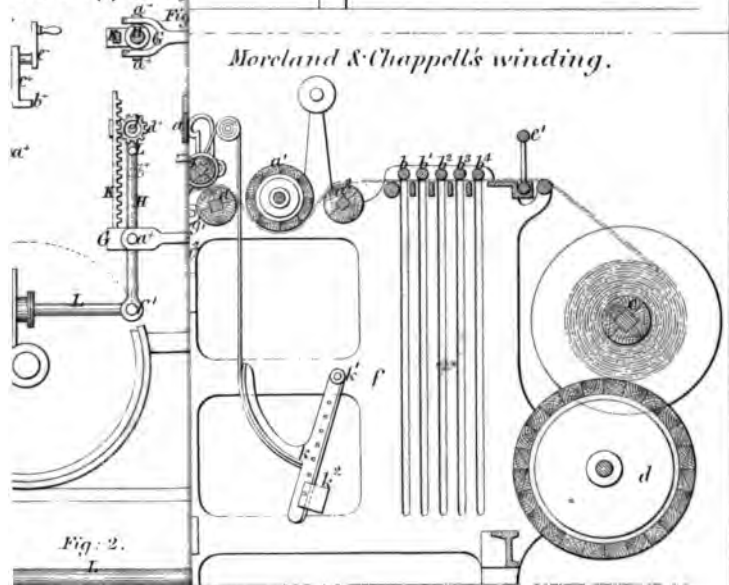




fire-arms. ig engines.



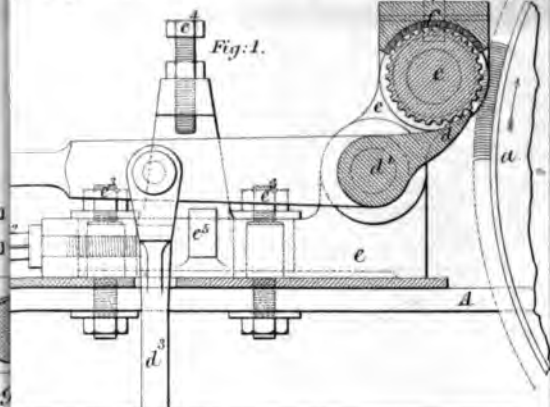
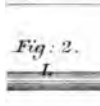
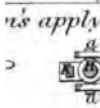
wheels applying



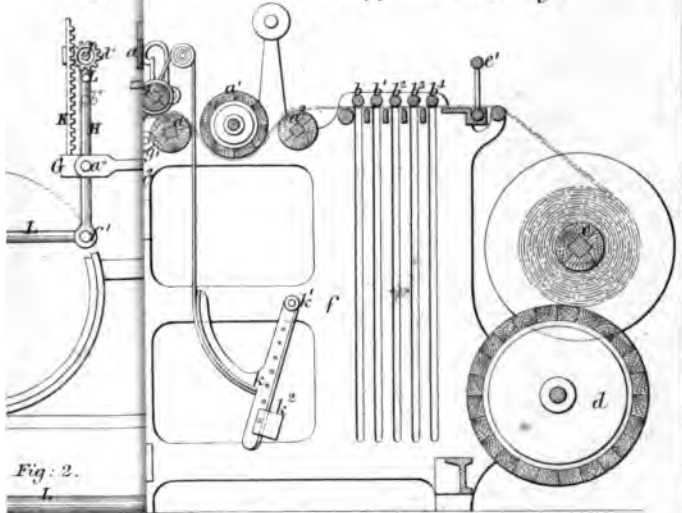


arms.

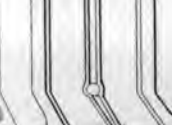
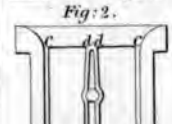
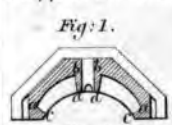
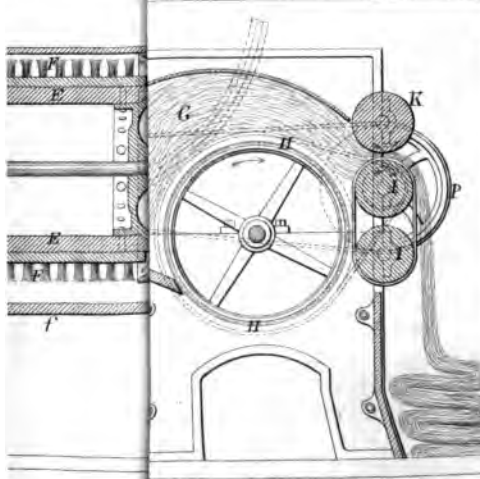
ing engines.



Moreland & Chappell's winding.



Philippi's axle boxes



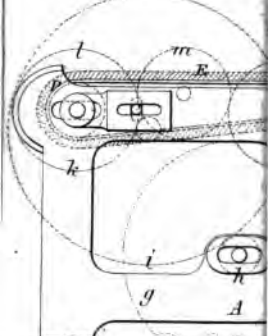






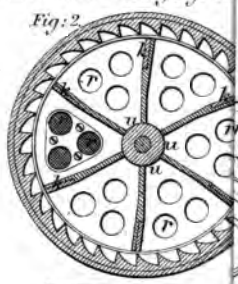


*Newton's separator*



*Maschiner's crushing & grinding*

*Fig. 2.*



*Markland & Dickinson's warping.*

*Fig. 2.*

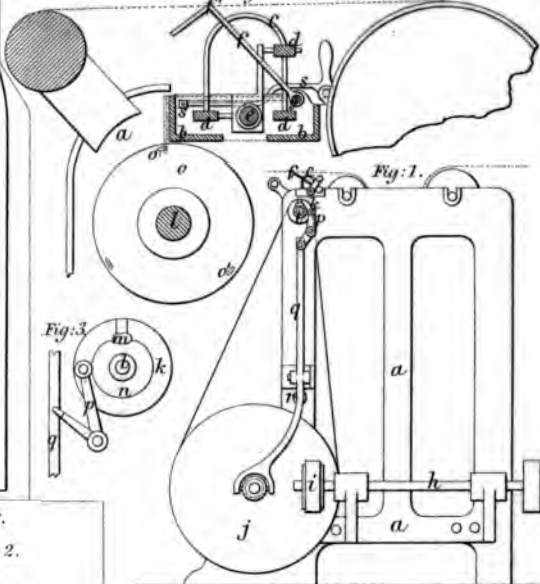
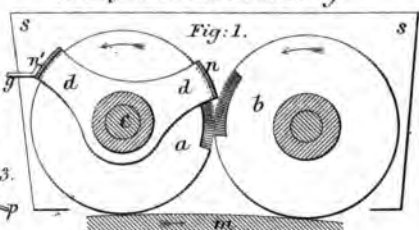


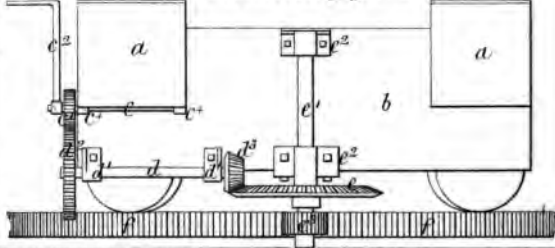
*Fig. 1.*

*Crosby & Smith's carding.*

*Fig. 1.*



*Reed's traversing guns.*



*Gimson's punching leather.*

*Fig. 1.*

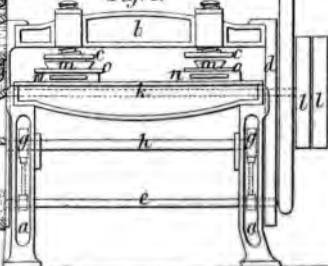
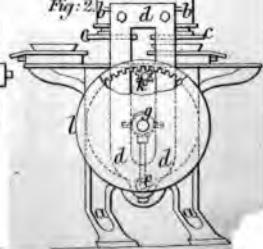
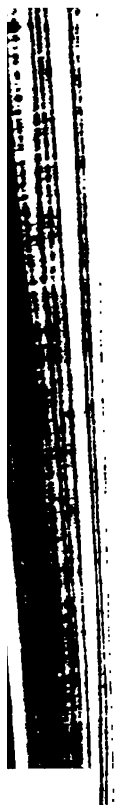
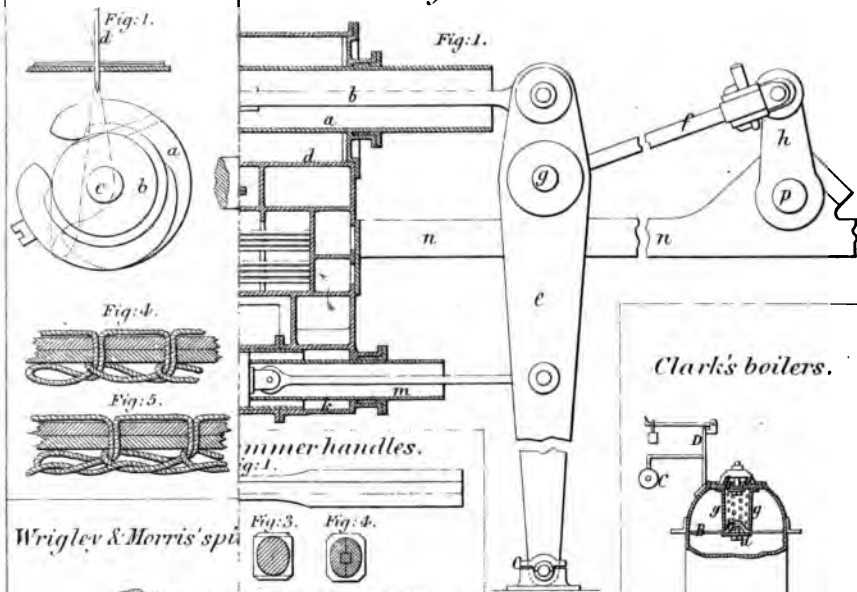


*Fig. 2.*

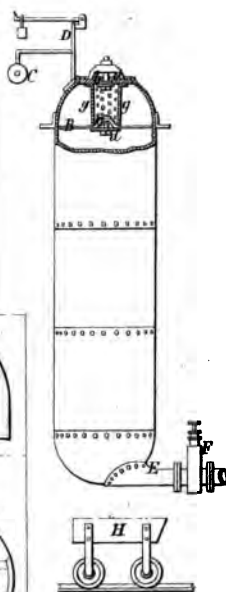




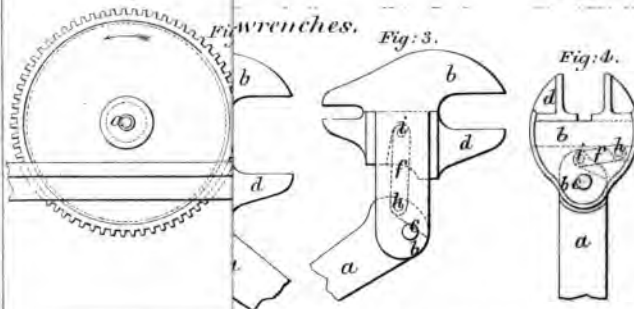
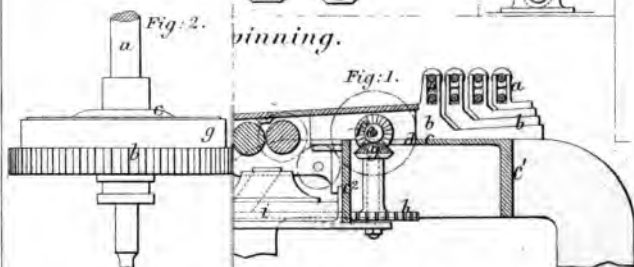
*Boeck's sewer's steam engines.*



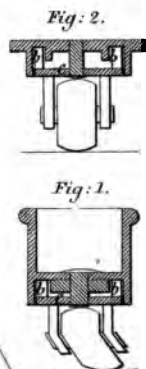
*Clark's boilers.*



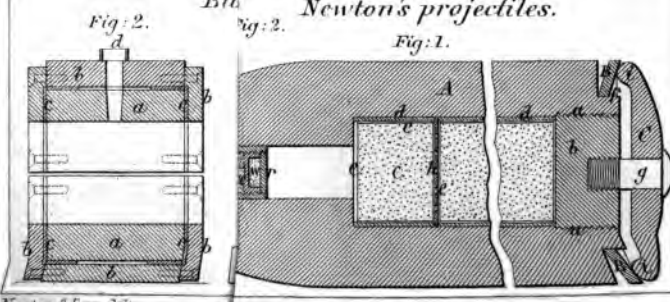
*Wrigley & Morris's spinning.*



*Fitter's castors.*



*Newton's projectiles.*





Gray's thrashing



Pepper & Dirck

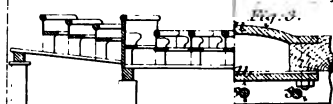


Fig. 3.

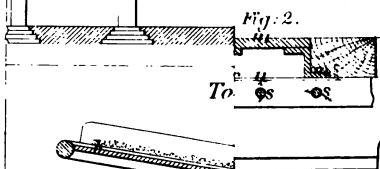


Fig. 2.

Edmonds' ventilating ships

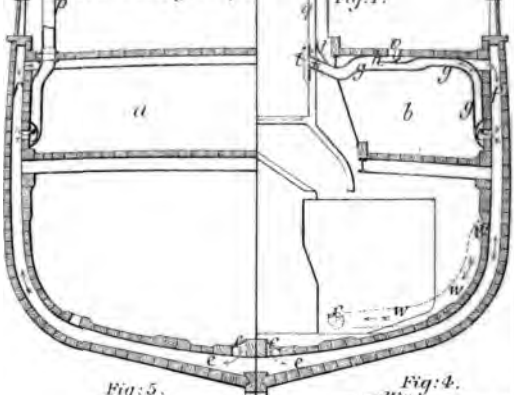


Fig. 1.

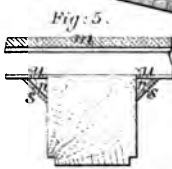


Fig. 5.

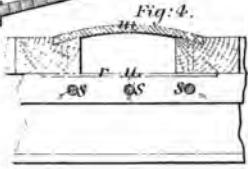


Fig. 4.

Symonds' propelling.

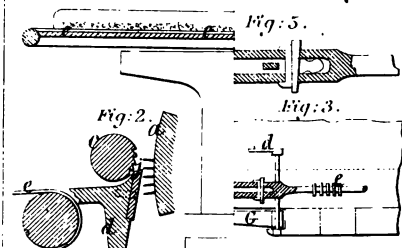


Fig. 2.

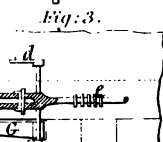


Fig. 3.

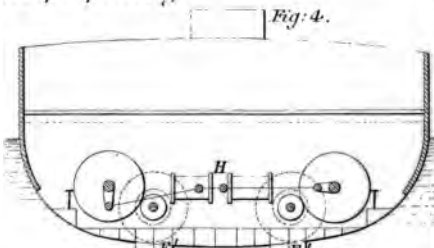


Fig. 4.

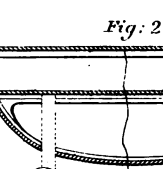
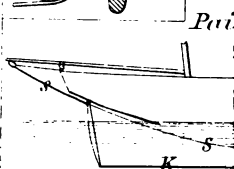


Fig. 2.

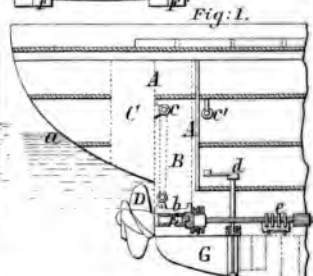


Fig. 1.

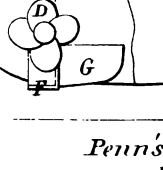
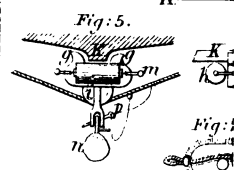


Fig. 3.

Penn's valves.

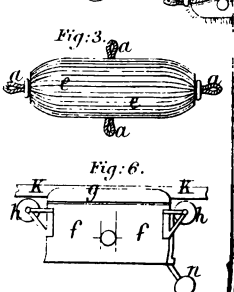


Fig. 3.

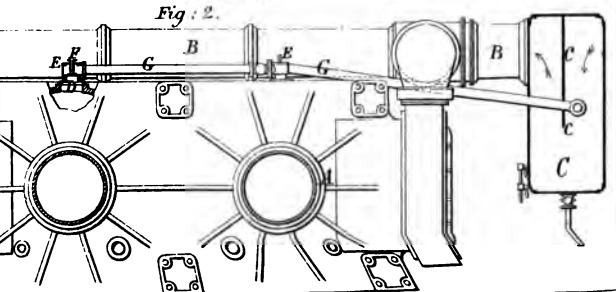
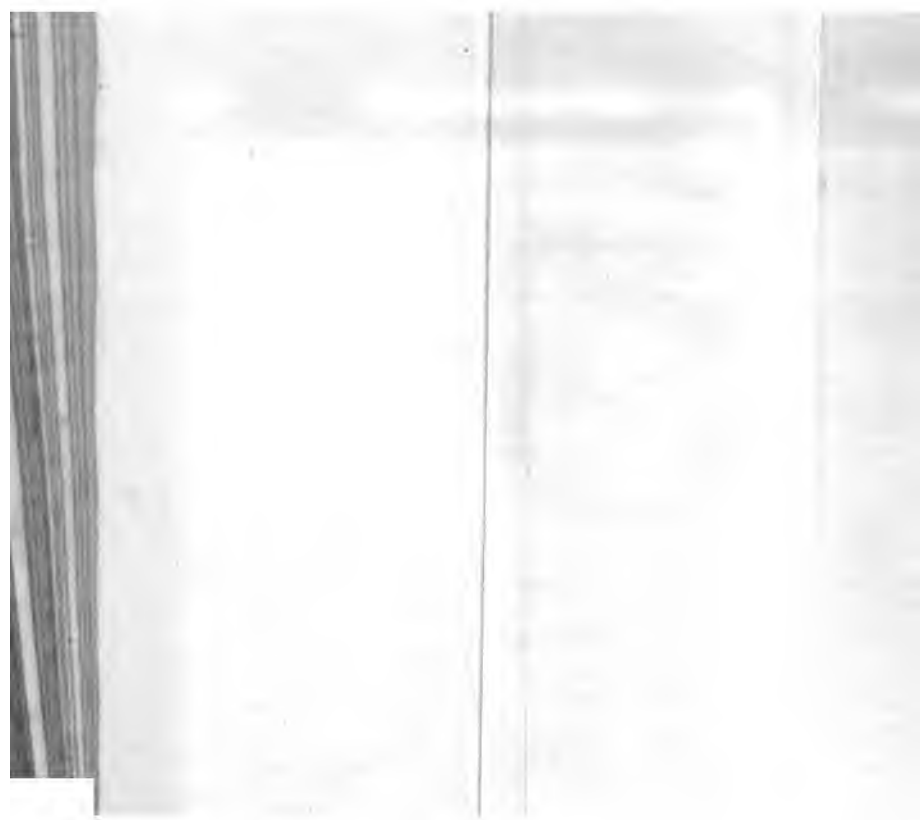
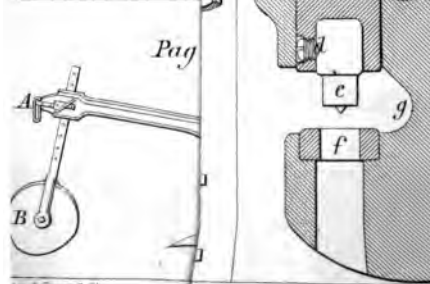
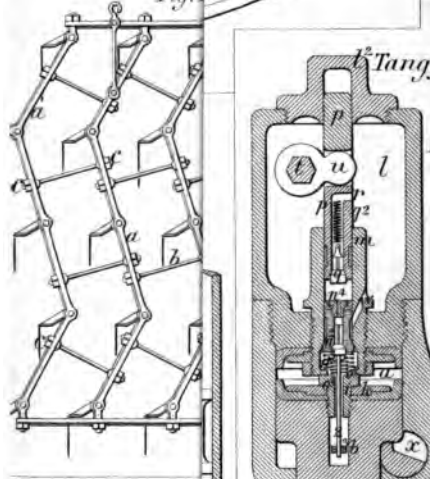
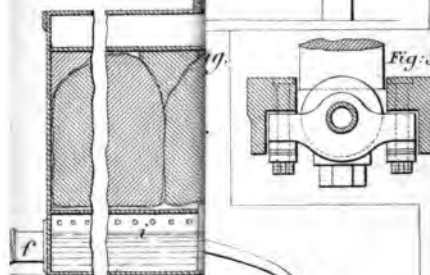
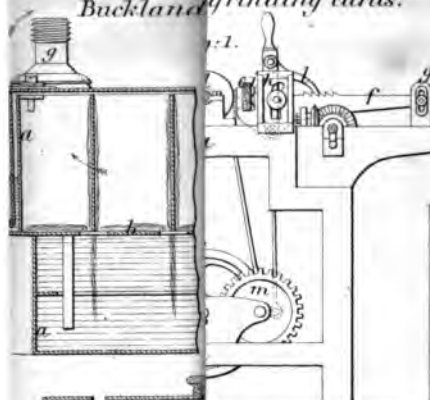


Fig. 2.

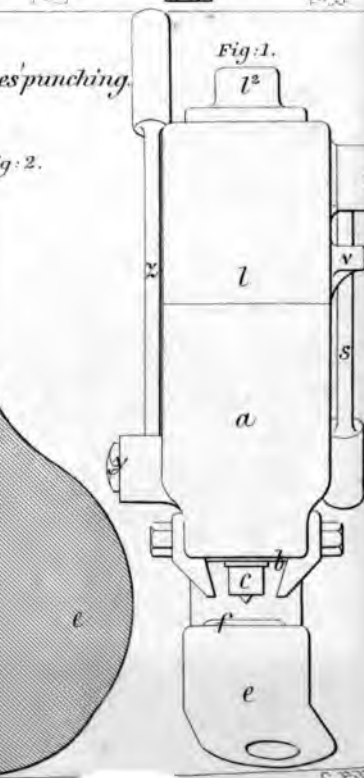
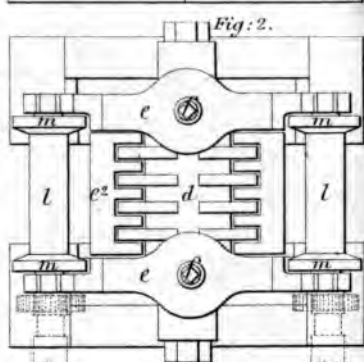
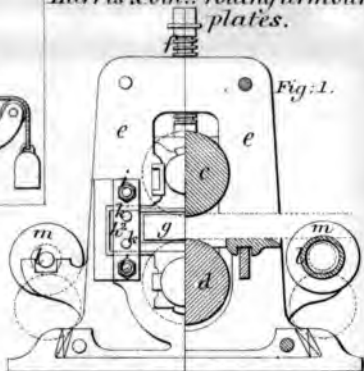




*Buckland's grinding cards.*



*Harris & Co's rolling armour plates.*



*Tangye's punching.*

